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Geology of Bossier Parish, Louisiana.

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GEOLOGY OF BOSSIER PARISH, LOUISIANA

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Subsurface information was obtained through the courtesy of the Louisiana Geological Survey under whose auspices this work was done and through the courtesy of the Ohio Oil Company, Shreveport, Louisiana. The geological and administrative personnel of this company made available to the writer electrical logs, sample logs and drafting space while field work was being conducted. The micro-paleontological log of the Moffitt #1 Antrim well was obtained from this organization.

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TABLE OF CONTENTS

LIST OF PLATES

LIST OF FIGURES

ABSTRACT

Geological investigations in Bossier Parish, Louisiana, disclose exposures ranging in age from lower Eocene Wilcox to middle Eocene Cook Mountain. Subsurface data indicate that the Sabine uplift, on the northeast flank of which Bossier Parish is situated, is complicated by several local structures in this area.

This investigation has produced the first detailed surface geological map of Bossier Parish. The Wilcox group of lower Eocene age is represented by 300 to 550 feet of sediments which are undifferentiated except for the uppermost sand unit, the Carrizo formation.

In Bossier Parish the interval between the top of the Wilcox group and the base of the Claiborne Sparta formation is undifferentiated throughout most of the parish. The sediments of this interval, 220 to 300 feet of glauconitic sand and clay, are mapped in central and southeast Bossier Parish as "undifferentiated lower Claiborne". In northwest Bossier Parish, adjacent to the Red River, this interval is divided into three formations which have been correlated by electrical logs with the Reklaw, Queen City and Weches formations of East Texas. Overlying these units are the Sparta formation, 220 to 350 feet of sand and interbedded sand and clay; and the Cook Mountain formation, 250 feet of glauconitic clay, sand and ironstone. These formations crop out in a general northwest-southeast belt across the parish and dip northeast at a rate from 15 to 60 feet per mile.

Two Pleistocene formations have been mapped in Bossier Parish and a third formation possibly is present. The youngest formation, the Prairie, is the only one to which a formal name has been applied; the other deposits are mapped as "undifferentiated terrace deposits". The Prairie surface extends over a large portion of Bossier Parish and tends to surround the Tertiary highlands. This surface is found to be 10 to 16 feet lower along tributary streams than the level along trunk streams. The same relationship is found in some of the recent alluvial deposits and is considered a possible explanation for the formation of Lake Bodcau during the last century. The topographically higher, older Pleistocene deposits are difficult to map due to lithologic similarities to the Tertiary blanket sands.

The Bellevue dome in east central Bossier Parish and the Sligo dome in south central Bossier Parish represent deformation which occurred along the edge of the Sabine uplift during the Tertiary. The Bellevue dome, which has undergone some 1,500 feet of vertical uplift, is indicated by the presence of Wilcox sediments as an inlier within the Claiborne outcrop. This structure lies along the northeast extremity of the Sabine uplift and is complicated by numerous faults.

The Sligo dome is situated on the Sabine uplift and has not experienced the degree of deformation undergone by the Bellevue dome. The structure is not as apparent as the Bellevue dome but is indicated by eastward dips on the base of the Carrizo formation in excess of the normal amount which is 30 to 40 feet per mile northeast.

In T22N, R14W, in the Gilmer Hill community of Bossier Parish, a series of northwest-southeast and northeast-southwest normal faults have been mapped. These faults have displacements ranging from about 10 feet to approximately 40 feet and may have resulted from a basement flexure in this area where subsurface contours indicate a change of strike of the Upper Cretaceous Annona formation from northwest to a more westerly direction.

This investigation was conducted under the auspices of the Louisiana Geological Survey.

INTRODUCTION

Purpose and Scope of Investigation

This investigation of the geology of Bossier Parish was conducted under the auspices of the Louisiana Geological Survey. A research grant from this organization supported the writer's field and laboratory work throughout the period required to complete the problem. A total of some eighteen months was spent in the field and laboratory phase of the investigation.

The primary purpose of this investigation was to map the surface geology of Bossier Parish. The study of electrical logs of wells in the parish resulted in the preparation of two subsurface geological maps, one contoured on the base of the Annona chalk (plate 2) and one contoured on the base of the Wilcox group (plate 3). These maps aided in the surface mapping of the parish. The base of the Taylor group of the Upper Cretaceous System was picked more or less arbitrarily as the depth limit of the subsurface investigation. E. G. Anderson of the Department of Geology, Louisiana State University, is presently engaged in the study of those sediments below this horizon.

Previous Investigations

Although previous reports of a regional nature have contained some information concerning the general physiography of Bossier Parish and geological data on certain restricted areas, this report presents the first detailed study of the geology of the parish.

Harris[1] in 1892 reported Claiborne fossils at the Pope Joy Cut on the St. Louis Southwestern Railroad between Plain Dealing and the Arkansas state line, as well as several other localities in northern Bossier Parish.

A. C. Veatch[2] in 1898 measured and described the section exposed at Coushatta Bluff on the Red River in Bossier Parish. On the basis of fossils found in these sediments, he stated that the section was more closely related to the "Lower Claiborne" than the Midway or the "Lignitic". Veatch collected a large quantity of fossil plants from this locality and sent them to Hollick[3] who contributed an illustrated paper on this flora to the preliminary report by Harris and Veatch[4]. In this paper Hollick[5] stated only that the plants represented a "Lower Tertiary" horizon. This collection was subsequently sent to the New York Botanical Gardens where Berry[6] restudied the plant assemblage and listed the locality as being near Coushatta, Red River Parish. The measured section made by Veatch at Coushatta Bluff was included in Berry's report so the locality

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[1] G. D. Harris, Annual Report for 1892, Geol. Surv. of Arkansas, vol. 2 (1894), pp. 179-180.

[2] A. C. Veatch and G. D. Harris, "Report on the Shreveport Area", La. Expt. Sta., Agr. La., part 5, Sp. Rept. 2 (1899), p. 200.

[3] A. Hollick, "A Report on a Collection of Fossil Plants from Northwest Louisiana", La. Expt. Sta., Agr. La., part 5, Sp. Rept. 5 (1899), pp. 278-289.

[4] Veatch and Harris, op. cit.

[5] Hollick, op. cit., p. 278.

[6] E. W. Berry, Lower Eocene Floras of Southeastern North America, U. S. Geol. Surv. Prof. Paper 91 (1916), p. 56.

from which Berry described the plant fossils was definitely that in Bossier Parish. It is not known whether this locality is the one referred to by Berry[7] in 1930 when he assigned the sediments at "Coushatta, La." to the "upper Wilcox horizon". The Bossier Parish locality lies within the outcrop of the Reklaw formation as mapped by the present writer.

Reports by Johnson[8] and Burchard[9] on the iron deposits of north Louisiana listed the occurrence of iron ores at various localities in Bossier Parish.

The geology of the Bellevue oil field of east central Bossier Parish was discussed in papers by Crider[10] and Teas[11] who included information on shallow faulting in the area and also noted the presence of lower Claiborne sediments on the northeast flank of the structure which forms the field.

Murray and Thomas[12] discussed in a general manner the relationship of Bossier Parish to the Sabine uplift in their paper on the

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[7] E. W. Berry, Revision of the Lower Eocene Wilcox Flora of the Southeastern States, U. S. Geol. Surv. Prof. Paper 156 (1930), p. 19.

[8] L. C. Johnson, The Iron Ore Regions of North Louisiana and Eastern Texas, 50th Cong., 1st Sess., H. Doc. 195 (1888), 54 pp.

[9] E. F. Burchard, Iron-Bearing Deposits of Bossier, Caddo and Webster Parishes, Louisiana, U. S. Geol. Surv. Bull. 620 (1915), pp. 129-150.

[10] A. F. Crider, "Geology of the Bellevue Oil Field", Bull. Am. Assoc. Pet. Geol., vol. 22 (1938), pp. 1658-1681.

[11] L. P. Teas, "Bellevue Oil Field, Bossier Parish, Louisiana", Structure of Typical American Oil Fields, vol. 2 (1924), Am. Assoc. Pet. Geol., Tulsa, Okla., pp. 229-253.

[12] G. E. Murray and E. P. Thomas, "Midway-Wilcox Surface Stratigraphy of the Sabine Uplift, Louisiana and Texas", Bull. Am. Assoc. Pet. Geol., vol. 29 (1945), pp. 45-70.

Midway-Wilcox stratigraphy of this structure.

In 1946 the Shreveport Geological Society published a geological map of Louisiana compiled by Wallace.[13] The youngest Eocene strata in Bossier Parish were mapped as Weches and no Sparta or Cook Mountain was mapped in any part of the parish.

C. R. Smith[14] published an article in 1958 on the Queen City-Sparta relationships in Caddo Parish. On the basis of electrical log correlations, he traced into Caddo and Bossier Parishes the Reklaw, Queen City and Weches formations of the southern part of the Tyler Basin, East Texas. He was able to trace the three members of the Queen City formation into Bossier Parish where they were recognized on the east bank of the Red River.

It is not the writer's intent to reiterate the evolution of formational nomenclature used in this area. The subject is discussed by Martin[15] and Howe[16] and is deemed superfluous for this report.

Location

Bossier Parish is located in northwest Louisiana and is bounded on the west by the Red River and Caddo Parish, on the south by Red River and Bienville Parishes, on the east by Webster Parish and on

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[13] W. E. Wallace, Geological Map of Louisiana, 1:500,000, Shreveport Geological Society (1946).

[14] C. R. Smith, "Queen City-Sparta Relationships in Caddo Parish, Louisiana", Bull. Am. Assoc. Pet. Geol., vol. 42 (1958), pp. 2518-21.

[15] J. L. Martin and Others, Geology of Webster Parish, Louisiana, La. Geol. Surv. Bull. 29 (1954), pp. 71-88.

[16] H. V. Howe, "Review of the Tertiary Stratigraphy of Louisiana", Bull. Am. Assoc. Pet. Geol., vol. 17 (1933), pp. 613-655.

the north by Lafayette County, Arkansas. It is one of the upland parishes of Louisiana and has a total land area of 841 square miles. The parish is covered by the following United States Geological Survey 15-minute series topographic maps: Bossier City, Caspiana, Coushatta, Minden, Mooringsport, Plain Dealing, Ringold, Sarepta and Vivian.

History and Development

Bossier Parish was created February 24, 1843, out of Claiborne Parish. Prior to 1828, Claiborne was a part of Natchitoches Parish, one of the original nineteen parishes established in 1807. The parish is named for General Pierre Evariste Jean Baptiste Bossier who was elected to Congress the same year Bossier Parish was created.

Surveys made prior to 1840 indicated only a few people living in the present area of the parish. The period 1840-1850 was the time of active settlement of the parish with people migrating primarily from the eastern seaboard of the United States.

Among the early settlements in Bossier Parish was Freedonia, later Liberty Hill and now Bellevue, the first parish seat. Other early communities in the parish were Collinsburg, southwest of Plain Dealing, Rocky Mount and Haughton. Rocky Mount is considered the oldest settlement in Bossier Parish.

Economic Geography

Most of the economic wealth of Bossier Parish, as far as agricultural pursuits are concerned, is restricted to the fertile soil of the Red River alluvium of western and southern Bossier Parish. Approximately 40 percent of the total acreage of the parish is tillable farmland, 40 percent is pasture land and the remainder is in timberland. The Tertiary uplands do not support extensive farming but contribute to the economy of the parish by furnishing large amounts of pulp wood.

Barksdale Air Force Base, located near Bossier City, is so situated to take advantage of the flat Red River alluvial surface. This installation contributes greatly to the economy of the area.

The present parish seat of Bossier Parish is Benton, a town of some 1,000 people located 15 miles north-northeast of Shreveport. The parish is served by the following railroads: St. Louis Southwestern, Kansas City Southern, Louisiana and Arkansas, and Illinois Central.

PHYSIOGRAPHY

Bossier Parish lies within the northern part of the Gulf Coastal Plain province. The parish can be divided into a central and eastern portion of Pleistocene deposits with a relatively flat surface, a northern portion of Tertiary uplands, and a northwestern, southwestern and southern portion of Red River alluvium. Extensive alluvial deposits are present along Bayou Bodcau and Cypress Bayou in the central and eastern part of the Parish. The Prairie formation, the youngest of the Pleistocene deposits, has a well-preserved surface over most of Bossier Parish. This surface extends from southern Bossier Parish north to the Arkansas state line and tends to surround the Tertiary highlands and to isolate them into "islands". The principal "islands" are as follows: the area around Haughton, Princeton and Red Point; Bellevue; and the area from Linton in T20N, R12W north and northwest to the Arkansas state line and the Red River. Smaller Tertiary exposures are found surrounded by Prairie deposits 2.0 miles northeast of Linton in sections 21 and 28, T20N, R12W; 2.5 miles northwest of Bellevue in sections 19 and 30, T20N, R11W and sections 24 and 25, T20N, R12W; along the Red Point-Bellevue road in sections 26, 27, and 34, T19N, R12W; and northwest of Benton along state highway 162 in T20 and 21N, R14W. Isolated to moderately extensive exposures of topographically higher Pleistocene deposits are found at various elevations throughout the central and south central part of the parish but no formational name is applied to them. These deposits are referred to herein as "Undifferentiated Terrace Deposits".

The highest portion of the Tertiary uplands occurs from T21N, R12W north and northwest to the parish boundary. The highest elevation in Bossier Parish, over 460 feet, occurs in this belt a few miles northwest of Plain Dealing. This upland area is developed on resistant sandstones and ironstones of the Claiborne Cook Mountain formation, forming a cuesta-like topography which slopes northeast. The terrain of the undifferentiated lower Claiborne and the Sparta formation to the south and southeast is more rolling than that of the Cook Mountain which is high and rugged.

The major drainage of the northern and central part of the parish is via Cypress Bayou and Bodcau Bayou which flow south into Red Chute Bayou which meets the Red River in northern Red River Parish. The east central part of the parish is drained by Clarke Bayou which empties into Lake Bistineau.

SUBSURFACE STRATIGRAPHY

General

The Upper Cretaceous formations of the Taylor and Navarro groups were assigned the writer for study during the early stage of this investigation of the geology of Bossier Parish. This assignment was an arbitrary one and was to include those sediments above the top of the Austin group.

The Upper Cretaceous formations considered herein crop out in southwestern Arkansas and dip gently to the south. In north Bossier Parish the top of the Upper Cretaceous System is about 1,700 feet below the surface. The lower limit of investigation for this study is the base of the Taylor group, placed herein just above the top of the so-called Blossom ? sand as defined by Martin[1] in Webster Parish.

Upper Cretaceous System

Taylor Group

Ozan Formation

In southwestern Arkansas, the base of the Ozan formation is placed at the base of a marly, glauconitic sand lentil, the Buckrange, which varies in thickness from 3 to 15 feet in Howard, Sevier and Hempstead Counties.[2] A subsurface cross-section by

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[1]Martin, *op. cit.*, p. 63.

[2]C. H. Dane, *Upper Cretaceous Formations of Southwestern Arkansas*, Ark. Geol. Surv. Bull. 1 (1929), p. xii.

Hazzard and Lloyd[3] from Dallas County, Arkansas, to Rusk County, Texas, shows this sand to pinch out at the Arkansas-Louisiana state line and a lower sand, the Blossom of the Brownstown formation, to continue into northwestern Louisiana. The presence of the Buckrange or Graves sand in southern Bossier Parish is not indicated on this cross-section. Martin[4] confirmed the pinchout of the Buckrange along the Arkansas-Louisiana state line and stated that the Buckrange reappears in southern Webster and Bossier Parishes. The Shreveport Geological Society published a cross-section from Natchitoches Parish, Louisiana, to Clark County, Arkansas, showing the Buckrange sand to pinch out at the state line and not to be present in southern Bossier Parish.

Plate 7 shows three sands present on electrical logs between the base of the Annona chalk and the top of the lower Austin chalky facies. According to the cross-section of Hazzard and Lloyd,[5] the upper sand is the Blossom of the Brownstown formation. This sand is termed "Blossom" by some geologists in the area and "Buckrange" by others. The correlation of the sands in the upper part of the Austin group and the lower part of the Taylor group will be established only by a regional subsurface study which is considered beyond the scope of the present investigation.

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[3] R. T. Hazzard and A. M. Lloyd, "Northeast-southwest Cross-Section from Dallas County, Ark., to Rusk County, Texas", Guide Book, 14th An. Field Trip, Shreveport Geol. Soc., (1939), p. 92.

[4] Martin and others, op. cit., p. 62.

[5] Hazzard and Lloyd, op. cit.

Martin[6] stated that the selection of the Brownstown-Ozan contact was impossible in areas where the Buckrange sand was absent; consequently, he arbitrarily placed the base of the Ozan formation just above the top of the Blossom ? sand. On electrical logs in Bossier Parish, the upper part of the Brownstown, above the Blossom ? sand, is very similar to the lower part of the Ozan. A composite electrical log[7] in southern Webster Parish shows the base of the Buckrange ? sand approximately 20 feet above the top of the Blossom ? sand. The interval between the base of the Annona chalk and the top of the Blossom ? sand in southern Webster Parish is about 270 feet, some 100 feet greater than the same interval in the Plaster #1 Tyrrell and Bass well, T18N, R10W (Plate 7), a few miles southeast of the Bellevue dome. This increase may be due to the reappearance of the Buckrange ? sand south and southeast of the #1 Tyrrell and Bass well.

The base of the Ozan formation is placed herein just above the top of the Blossom ? sand, following the usage of Martin to the east in Webster Parish. Plate 7 shows the correlation of this sand as well as other subsurface units in Bossier Parish above the base of the Upper Cretaceous.

In Bossier Parish the Ozan formation consists of 80 to 180 feet of gray chalk with some samples containing impure volcanic ash. The Ozan, in contrast to the overlying Annona formation, thickens to the east in Bossier Parish, reaching a maximum thickness of 180 feet in

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[6]Martin and others, <u>op. cit.</u>, p. 63.

[7]<u>Ibid.</u>, plate 14.

the Cotton Valley area. The thickness ranges from 80 to 100 feet in the west central and northwestern portion of the parish to 130 to 180 feet in the eastern portion along the Webster Parish line. Over the crest of the Bellevue dome in east central Bossier Parish, the Ozan is some 130 feet thick. South and southeast of this structure the unit is some 180 feet thick.

According to Martin,[8] the Ozan is a marine marl in Webster Parish and to the east in Claiborne and Union Parishes it becomes sandy.

Alden Bridge, Cottage Grove and Elm Grove oil fields are reported[9] to produce from the Ozan. The producing zone is the sand (Blossom ? of Martin) below the Ozan as defined herein.

A micropaleontological log of the Moffitt #1 Antrim well, section 26, T22N, R12W, was obtained from the Ohio Oil Company, Shreveport, Louisiana. The identifications were made by an anonymous paleontologist in 1934 and are included herein with the stipulation that some of the specific identifications may be incorrect. No samples were available for personal examination by the writer. The following Foraminifera and Ostracoda were found in the Ozan in the #1 Antrim:

Anomalina pertusa (Marsson)
Gyroidina depressa (Alth)
G. micheliniana (d'Orbigny)
Globigerina cretacea (d'Orbigny)
Kyphopyxa christneri (Carsey)
Planulina taylorensis (Carsey)
Valvulineria ripleyensis Sandidge

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[8] Ibid., p. 63.

[9] Statistics of Oil and Gas Development and Production (1956). La. Geol. Surv., pp. 16-17.

Annona Formation

In Bossier Parish the Annona consists of 100 to 160 feet of hard white chalk with gray shale stringers. It thins from 160 feet in northwestern Bossier Parish to about 110 feet in the southern part of the parish. In Webster Parish to the east the formation is about 100 feet thick in the Cotton Valley area.

The Ozan-Annona contact on electrical logs is quite sharp and retains is character over wide areas. Plate 2 is a subsurface contour map on the base of this unit.

The following microfossils were reported from the Moffitt #1 Antrim:

Amonalina pertusa (Marsson)
Cibicides excolata (Cushman)
Gyroidina micheliniana (d'Orbigny)
Gaudryina stephensoni Cushman
Planulina taylorensis (Carsey)

Bairdia obliqua Alexander

Marlbrook Formation

The Marlbrook is a uniform section of gray to dark-blue chalky shale and marl some 200 feet over most of northern and central Bossier Parish. It thins to 120 feet in the Bellevue area and to some 125 to 140 feet in southern Bossier Parish. The Marlbrook thickens to 170 feet in southern Webster Parish.

The basal part of the Marlbrook is difficult to distinguish from the underlying Annona on electrical logs due to a gradual change in character from the upper part of the Annona into the lower part of the Marlbrook . The upper part of the formation grades into the lower shaly section of the overlying Saratoga with little discernible break. No microfossils from this unit were reported from the Moffitt #1 Antrim.

Navarro Group

Saratoga Formation

In Bossier Parish the Saratoga formation consists of 40 to 80 feet of chalk and chalky shale which is rather difficult to trace on electrical logs. The unit is variable lithologically, consisting in places of a rather uniform chalk, 60 to 80 feet thick, which is easily recognized on electrical logs. In other places, particularly in the western portion of Bossier Parish, electrical logs indicate a chalk development of less than 40 feet. Due to this variation, the formation is difficult to correlate across the parish. The top of the Saratoga is placed at the top of the first chalk below the Nacatoch shales. The lower boundary is indicated on plate 7 by a dashed line because this point is almost impossible to determine on electrical logs.

The Shreveport Geological Society[10] places an unconformity at the top of the Saratoga, but this surface is not determined readily from electrical logs. The Annona, Marlbrook and Saratoga formations are grouped by many geologists as "chalk rock" due to strong lithologic similarities.

The following Foraminifera were reported from this interval in the Moffitt #1 Antrim:

<u>Anomalina pertusa</u> (Marsson)
<u>Arenobulimina presli</u> (Reuss)
<u>Bulimina murchinsoniana</u> d'Orbigny
<u>Cibicides constricta</u> (v. Hagenow)

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[10]Shreveport Geol. Soc., <u>Reference Report on Certain Oil and Gas Fields of North Louisiana, South Arkansas, Mississippi and Alabama</u>, vol. 2 (1945), pl. 6.

C. excolata (Cushman)
Heterostomella sp.
Planularia taylorensis (Carsey)

Nacatoch Formation

The Nacatoch formation is 400 to 500 feet thick in northern Bossier Parish near the Arkansas state line and consists of an upper fine-grained to medium-grained limy and shaly sandstone and a lower gray clay and sandy lime. The thickest section of the Nacatoch seen on electrical logs by the writer is in the Carter #1 Smith well in section 2, T23N, R13W where 510 feet of Nacatoch is present, of which 420 feet is sandstone. The unit thins southward to about 250 feet in southern Bossier Parish with most of the thinning occurring in the lower shale section. On electrical logs the Nacatoch appears to be conformable with the Arkadelphia above and the Saratoga below even though some geologists place an unconformity at the base of the formation. In some wells the lower part of the formation is quite sandy, leaving only a very thin shale section. In areas where chalk development is lacking in the top of the Saratoga, the base of the Nacatoch is difficult to pick. In Webster Parish the formational thickness is about the same as that in eastern Bossier Parish, i.e., some 350 feet.

The Nacatoch is a prolific oil and gas-producing horizon in Bossier Parish as well as other areas of north Louisiana. Bellevue, Elm Grove, Shreveport and Sligo fields produce either oil or gas from this unit which is termed "gas rock" by many drillers in the area.

The following Foraminifera and Ostracoda were reported from the Moffitt #1 Antrim:

Anomalina pseudopapillosa Carsey
Clavulina insignis Plummer
Discorbis correcta Carsey
Gaudryina rugosa d'Orbigny
Globotruncana arca d'Orbigny
Gumbelina sp.

Brachycythere ovata (Berry)
B. rhomboidalis (Berry)
Cythereis communis (Israelsky)
Cytheridea micropunctata Alexander

Arkadelphia Formation

In northwestern Bossier Parish the Arkadelphia formation consists of 60 to 70 feet of shaly chalk underlain by the same thickness of chalky shale. This distinctive relationship is lost southward in the parish where the formation consists of about 100 feet of shale, chalk and marl. The thickness of the formation is rather constant throughout the west central and northwestern portion of the parish, averaging 130 feet. The Arkadelphia thins eastward to about 90 feet in northern Webster Parish. Over the crest of the Bellevue dome in east central Bossier Parish the formation is about 80 feet thick, but it increases in thickness east and southeast of this structure as the Minden syncline is approached.

The upper limit of the Arkadelphia is difficult to determine from electrical logs due to strong lithologic similarity to the basal Midway formation, the Clayton, which it underlies. The selection of this contact is primarily a paleontological one and, without samples from this interval, is not determined readily from electrical logs.

No fields in Bossier Parish produce oil or gas from this horizon. The Moffitt #1 Antrim yielded the following microfossils from this formation:

Dorothia bulletta (Carsey)
Globigerina rugosa Plummer
Globotruncana arca (Cushman)
Gumbelina excolata Cushman
Pseudotextularia sp.

Cytheridea fabaformis (Berry)

Tertiary System

Paleocene Series

Midway Group

The Midway group is represented in the subsurface of Bossier Parish by 400 to 600 feet of sediments lying above the top of the Arkadelphia formation and below the Wilcox group. The Midway lithology is primarily a dark-gray to black clay, the Porters Creek formation, underlain by a variable calcareous shale or shaly chalk 15 to 20 feet thick, the Clayton formation. The thickness of the group is rather constant over wide areas of the region. Plate 8 shows the relationship of this group to the other lower Tertiary units in northern Bossier Parish. Thinning occurs over the crest of the Bellevue dome in T19N, R11W where, on electrical logs, a thickness of less than 200 feet is present beneath fresh-water sands of the Pleistocene deposits which mantle the area. The Seigal #2 Sample Mucher well in section 23, T19N, R11W has only 180 feet of Midway section remaining beneath approximately 140 feet of Pleistocene deposits. In some wells in the central part of the Bellevue oil field Midway shales extend to within 50 feet of the surface which, due to Pleistocene deposits, shows very little expression of the large amount of uplift which this structure has experienced.

Crider[11] considered the central portion of the Bellevue dome to be residual Midway soil forming the grass-covered prairie which extends eastward into Webster Parish. Bore holes drilled on this surface revealed typical Pleistocene lithology of tough red clay and sand. This surface is correlated with the Prairie terrace in adjacent areas of the parish. The Bellevue oil field is located near the head of Clarke Bayou which flows southward into Lake Bistineau. Elevations on the Bossier City and Minden Quadrangle maps indicate an extensive flat reaching from T20N, R10W south to the vicinity of the Louisiana Ordnance Plant in T18N, R10W and extending west to state highway 157, an area some 80 square miles in size. The drainage from the northwestern and central part of this area is concentrated into the head of Clarke Bayou in the middle of the Bellevue field, producing a low, swampy terrain in which Pleistocene deposits and Recent alluvium are difficult to distinguish. These deposits form the gray soil which Crider considered Midway in age. The present writer does not consider sediments of Midway age to be exposed anywhere in Bossier Parish.

The following Foraminifera were identified from the Midway in the Moffitt #1 Antrim:

Anomalina midwayensis (Plummer)
Eponides tenera (Brady)
Globigerina triloculinoides Plummer
Valvulineria allomorphinoides (Reuss)

[11]Crider, *op. cit.*, p. 1663.

SURFACE STRATIGRAPHY

Introduction

The surface deposits of Bossier Parish are confined to the Wilcox and Claiborne groups of the Eocene Series and the alluvial deposits of the Quaternary System which overlie them unconformably. Formations of the Tertiary System include the undifferentiated sediments of the Wilcox group with the Carrizo formation at the top, and the undifferentiated lower Claiborne, Reklaw, Queen City, Weches, Sparta and Cook Mountain formations of the Claiborne group.

The Wilcox group consists of 350 to 550 feet of essentially non-marine micaceous, feldspathic sands, lignitic shales and lignites. The uppermost unit of this group, the Carrizo sand, is separated from the underlying sediments and is mapped in two moderately extensive areas of Bossier Parish. This sand is assigned to the Wilcox group for reasons discussed on page 31. This is in keeping with the usage of most workers in Louisiana.

The Claiborne group is represented by deposits of the lower Claiborne interval, the Sparta formation and the Cook Mountain formation. The lower Claiborne interval includes the Reklaw, Queen City and Weches formations in northwestern Bossier Parish where sand members of the Queen City permit separation of the Reklaw from the Weches. These formations have been correlated[1] on electrical logs

[1] Smith, op. cit., pp. 2518-2519.

with the Reklaw, Queen City and Weches formations of the southern half of the Tyler Basin, East Texas. Southeast of this area, T21 and 22N, R14W, the Queen City sands pinch out and the lower Claiborne interval becomes an undifferentiated unit mapped herein as "undifferentiated lower Claiborne". The undifferentiated lower Claiborne consists of 220 to 300 feet of glauconitic sands and clays and fossiliferous, sideritic ironstones cropping out in an interrupted belt from Haughton in T18N, R11W northwest to T21 and 22N, R14W where it is separated from the Reklaw, Queen City and Weches formations by a normal fault. The Sparta formation is an essentially non-marine quartz sand unit 220 to 350 feet thick, exposed in a northwest-trending belt from T20N, R12W to Millers Bluff in T22N, R14W. The Cook Mountain formation is similar lithologically to the undifferentiated lower Claiborne but it is sandier and contains a great quantity of moderately fossiliferous sideritic and limonitic ironstone, producing the "redland" area of Bossier Parish. This formation is some 250 feet thick in northwestern Bossier Parish and is exposed in a wide belt from Rocky Mount in T20N, R12W to the Arkansas state line. Plate 4 indicates lithological symbols used on some plates in this report.

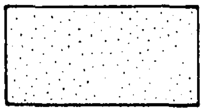
Tertiary System

Eocene Series

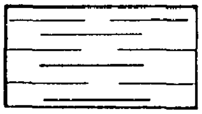
Wilcox Group

The Wilcox group in Bossier Parish is represented by exposures of considerable areal extent but the sediments are so similar lithologically that no differentiation is attempted except for the uppermost sand unit, the Carrizo formation. The Carrizo sand ranges

Lithologic Symbols used on plates in this report.



Sand



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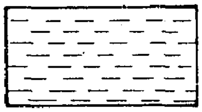
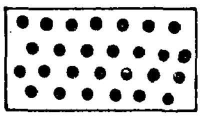
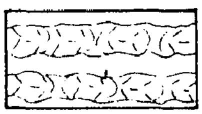


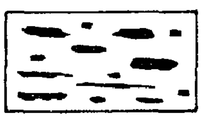
Silt



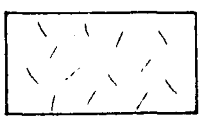
Glauconite



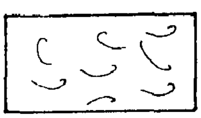
Sideritic ironstone



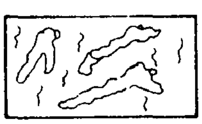
Lignite



Mica



Fossils



Borings

PLATE 4

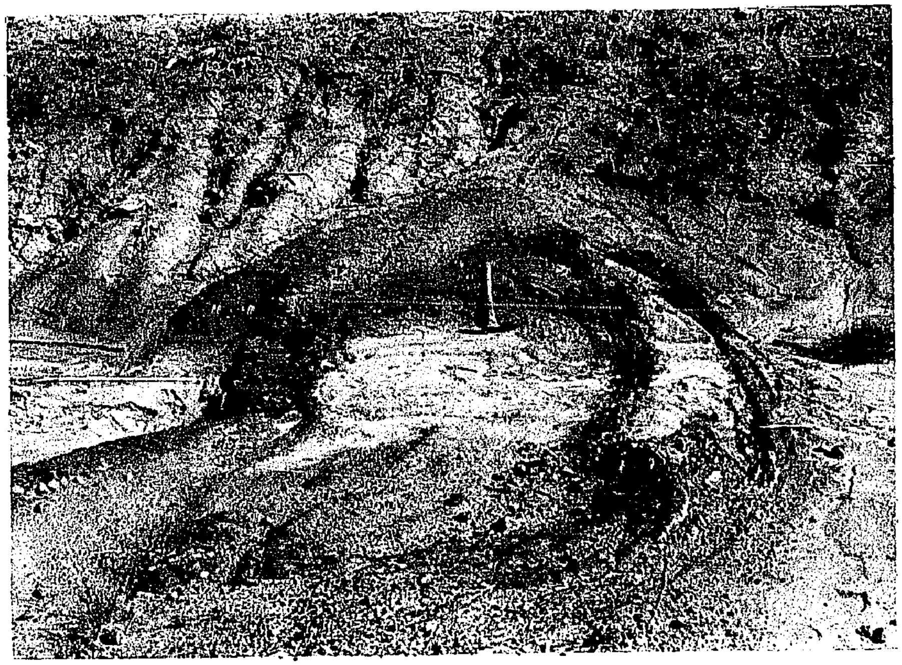
in thickness from zero to over 80 feet. The undifferentiated sediments consist largely of non-marine micaceous, sandy silts, sands and clays with irregular lignite stringers and fragments of fossilized wood.

The thickness of the group varies from 350 to 370 feet in west central Bossier Parish to a maximum of 550 feet north of the Bellevue dome in east central Bossier Parish. Along the northern boundary of the parish, the group has an average thickness of 425 feet. Little information is available on the Wilcox deposits of southern Bossier Parish where an undetermined amount of these sediments was removed by erosion prior to the deposition of the Pleistocene formations. The base of the group is not exposed in the parish.

The Wilcox group in Bossier Parish is largely non-fossiliferous, containing only a poor arenaceous foraminiferal fauna unsuitable for stratigraphic differentiation.

The principal area of outcrop of the Wilcox group is in townships 18 and 19 north and ranges 11 and 12 west, extending from the community of Bellevue south and southwest to an east-west line some 2 miles south of Haughton. The topography developed on these sediments is rolling and heavily timbered so that few good exposures are available for study.

In the stream gullies a few hundred yards southwest of the main cross-roads in the community of Bellevue are exposed sections of undifferentiated Wilcox. The lithology here is primarily gray silty clay and tan to buff lignitic sand. Large calcareous sandstone concretions (figs. 1 and 2) are exposed in the head of a stream gully



Figs. 1 and 2. Glauconitic sandstone concretions in undifferentiated Wilcox sediments at Bellevue, section 5, T19N, R11W.

a few hundred feet west of H. E. Roberts' store. Associated with these concretions are gray to tan sands and clays which are well-exposed along state highway 157 northwest of Bellevue.

The community of Bellevue itself is located on Wilcox sediments which were designated Cane River by Crider.[2] A series of large glauconitic sandstone concretions occurs exposed in the road cuts (figs. 1 and 2) in and around the community. These have a dark-green to red color which Crider probably associated with the lower Claiborne glauconites of the Fillmore area to the south. Bore hole 58-13 was drilled 100 feet north of Roberts' store in Bellevue and encountered 35 feet of silty, lignitic, feldspathic quartz sand, typical Wilcox lithology.

One mile north of Bellevue a fault separates the Wilcox from undifferentiated lower Claiborne glauconites which are exposed along the south side of Bayou Bodcau from the dam in section 28 to the fault which is downthrown to the northeast. A series of bore holes (57-20, 21 and 22) was drilled in sections 29 and 32, T20N, R11W and encountered Claiborne glauconitic clays north of the fault and Wilcox lignites and pyritic clays south of the fault which extends toward the Bellevue field to the southeast.

The amount of thinning of the Wilcox group over the Bellevue dome is not known due to the removal of much of the original thickness by Pleistocene erosion. The Midway group is thinner here, and it is probable that the Wilcox is not as thick as in areas surrounding the

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[2]Crider, _op. cit._, p. 1663.

structure. A bore hole drilled north of the crest of the dome in NW$\frac{1}{4}$, SW$\frac{1}{4}$, section 33, T20N, R11W encountered, beneath 39 feet of undifferentiated terrace deposits, black, kaolinitic clay, typical Porters Creek lithology, overlying lignitic, feldspathic, Wilcox-like sand. This may indicate an interfingering of Midway-Wilcox lithologies around the crest of the dome during late Paleocene-early Eocene time. The base of the Wilcox group on the crest of the structure was found on electrical logs to be about 150 feet below the surface and overlain by 50 to 100 feet of Pleistocene deposits.

The undifferentiated Wilcox sediments extend southwest from Bellevue along the south side of Bayou Bodcau a distance of some 5 miles in an uninterrupted belt. A few isolated exposures occur beyond this point surrounded by Prairie deposits which extend northward from the community of Red Chute in T18N, R12W.

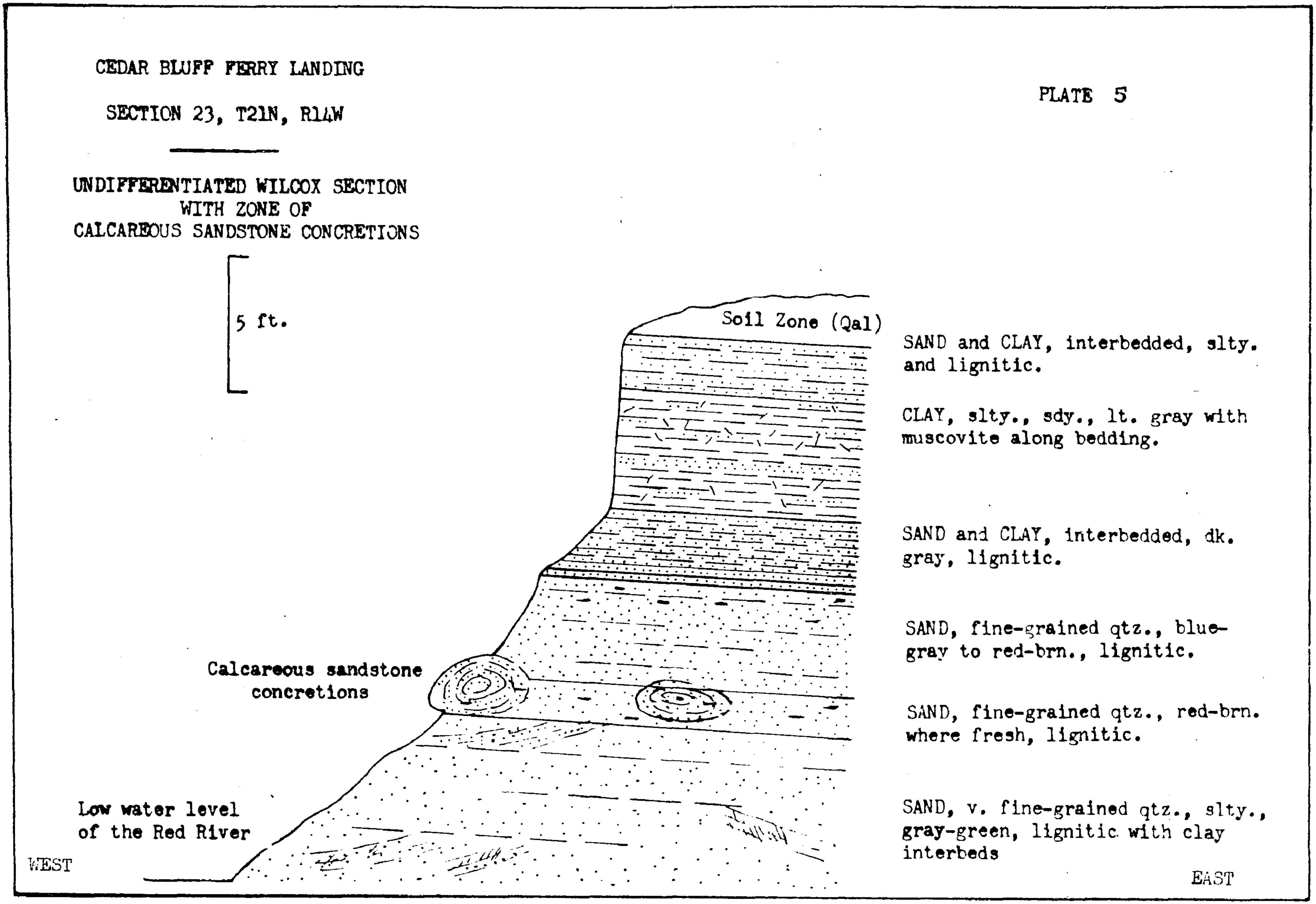
Wilcox deposits of a limited extent are found within the Barksdale Air Force reservation in T18N, R11W but security measures of the U. S. Air Force prevented free access to the area for detailed mapping. At least two Pleistocene formations are present in this area and they greatly hindered mapping of the Tertiary units. Dips in this area are east to northeast from the Sligo structure, a northwest-southeast trending dome centered in sections 26 and 27, T17N, R11W. Electrical logs of wells drilled in the Sligo oil field do not include the shallow horizons so no thickness can be determined for the Wilcox in this part of the parish.

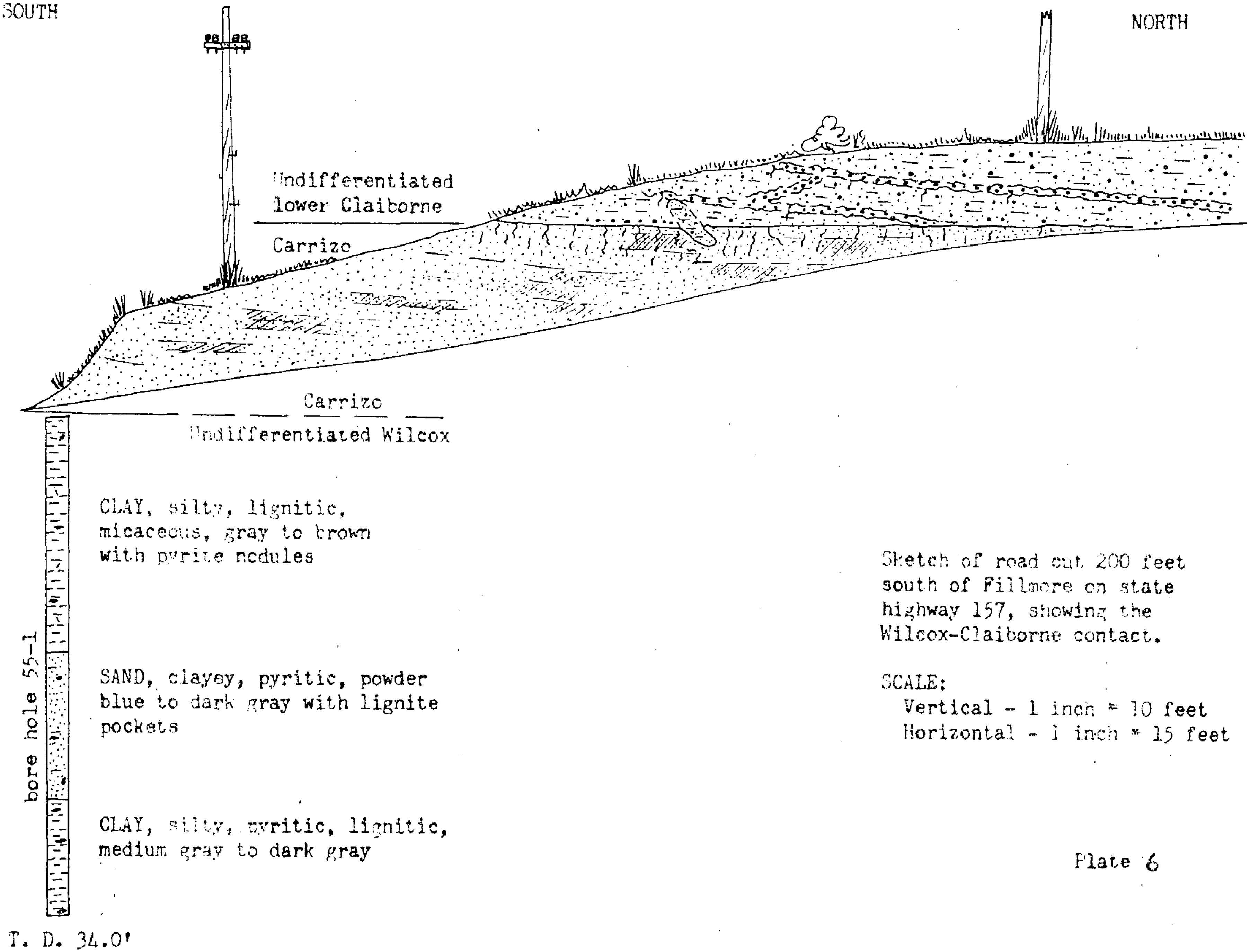
Around Red Chute in T18N, R12W the Wilcox is overlain by approximately 100 feet of Prairie sands and silts. Water wells drilled in section 4 of this township penetrated from 100 to 125 feet of coarse quartz sand and tough, red clay before encountering tight, blue Wilcox clays and lignitic sands. The contact between the Wilcox and Prairie sediments north of Red Chute along the road to Bellevue is difficult to pick and the selection was made largely on topographic interval. The well-defined terrace surface south of Red Chute becomes less distinct north of U. S. Highway 79-80, and the Wilcox is difficult to recognize. The two are similar in their weathered appearance and surface expression.

A well-exposed section of undifferentiated Wilcox is present at the abandoned Cedar Bluff ferry landing on the Red River in section 23, T21N, R14W. Here, as at Bellevue, calcareous sandstone concretions are exposed on the lower part of the bluff (plate 5). These two localities are the only places at which these concretions have been observed by this writer in Bossier Parish. The beds at this bluff are dipping eastward at 6 to 7 degrees, implying a fault in the area. There is no well control to establish a possible trend for this fault, if it exists. Such dips may be due to gross cross-bedding, but this is not thought to be the case in this instance. The area surrounding this bluff section is masked by Pleistocene and Recent deposits and no fault trace was observed.

Carrizo Formation

The contacts of this formation are well exposed at only two localities in Bossier Parish. The better locality (plate 6) is a road cut on state highway 157 a few hundred feet south of Fillmore in section 8, T18N, R11W. At this road cut the Carrizo is 13 feet


CEDAR BLUFF FERRY LANDING
SECTION 23, T21N, R14W
UNDIFFERENTIATED WILCOX SECTION
WITH ZONE OF
CALCAREOUS SANDSTONE CONCRETIONS
5 ft.
PLATE 5
Soil Zone (Qal)
SAND and CLAY, interbedded, slty. and lignitic.
CLAY, slty., sdy., lt. gray with muscovite along bedding.
SAND and CLAY, interbedded, dk. gray, lignitic.
SAND, fine-grained qtz., blue-gray to red-brn., lignitic.
SAND, fine-grained qtz., red-brn. where fresh, lignitic.
SAND, v. fine-grained qtz., slty., gray-green, lignitic with clay interbeds
Calcareous sandstone concretions
Low water level of the Red River
WEST
EAST



Sketch of road cut 200 feet south of Fillmore on state highway 157, showing the Wilcox-Claiborne contact.

SCALE:
Vertical - 1 inch = 10 feet
Horizontal - 1 inch = 15 feet

Plate 6

thick and consists of fine-grained to medium-grained, angular, yellow-brown, quartz sand with numerous thin, gray clay laminae. The sand is slightly glauconitic in the upper 3 to 4 feet with small borings (figure 4) extending down 2 to 3 feet below the contact. These borings are filled with dark-red, glauconitic, clayey sand of the overlying Claiborne. A distinct color change is observed at the contact. Plate 6 indicates the position and attitude of a peculiar oblong mass situated at the contact. This mass, some 5 feet long, projects an equal distance into both formations and, although composed of the dark-red, clayey sand of the Claiborne, it is clearly outlined in the road cut as a slight depression. It possibly represents the filling of a space left by the rotting and subsequent removal of a log.

Two partially-indurated, red-brown glauconite ledges occur in the lower few feet of the Claiborne at this point. The sand between these ledges is only slightly glauconitic and resembles the underlying Carrizo. A thin crust of glauconitic ironstone occurs in places between these ledges, giving the sand a dark-red stain.

The Carrizo-undifferentiated Wilcox contact is present in the bottom of the ditch at the south end of this road cut but is not well exposed. Bore hole 55-1 (plate 6) was drilled just above this contact in the ditch and penetrated 34.0 feet of silty, lignitic clay and pyritic sand of the undifferentiated Wilcox. This contact is better exposed in a cut on the Illinois Central Railroad 1.55 miles west of Haughton in the center of SW$\frac{1}{4}$, section 20, T18N, R11W. At this locality (fig. 3), the undifferentiated Wilcox-Carrizo contact is an uneven erosional surface. The thickness of the Carrizo sand in the larger troughs above this irregular surface is 7 to 8 feet. The upper 2 or 3 feet of this cut is composed of slightly glauconitic, clayey sand of the undifferentiated lower Claiborne. The Carrizo is non-glauconitic here and the base of the Claiborne was selected at the first occurrence of glauconite. The base of the Claiborne is not clearly defined due to weathering of the face of the cut.

Stenzel,[3] discussing the Carrizo-Reklaw contact in East Texas, wrote the following:

> There the uppermost 5 to 10 feet of the Carrizo formation is glauconitic and fossiliferous, although very sparingly so. The Reklaw formation lies disconformably on the Carrizo and at the base consists of fossiliferous glauconite beds. Nevertheless, there is a good contrast in over-all lithologic composition. The uppermost Carrizo is a soft very dark brown muscovitic slightly glauconitic sparingly fossiliferous very silty and sandy carbonaceous clay; the overlying Reklaw is a sequence of soft to hard light gray-green glauconitic fossiliferous argillaceous slightly calcareous or sideritic sands. The two formations can be distinguished in fresh exposures at a glance by color alone, the upper Carrizo being dark brown and the lower Reklaw being light gray-green. The fact that there is glauconite present above and below the disconformity does not disprove the disconformity, which can be demonstrated by many of its characteristic features.

In this same paper Stenzel lists five physical features of marine transgressive regional disconformities.[4] Among these are two: (1) uneven erosional surface at the disconformity separating the two sedimentary sequences, (2) animal burrow holes filled with the material from the overlying sequence and extending into the underlying one.

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[3] H. B. Stenzel, "Boundary Problems", Guide Book, 9th Field Trip, Miss. Geol. Soc., (1952), p. 29.

[4] Ibid.

These two physical features of disconformities, burrow holes and uneven erosional surface, are associated with the upper contact of the Carrizo formation in Bossier Parish. According to the criteria listed above, a disconformity, based on animal burrows, could be placed at the top of the Carrizo at the Fillmore locality (plate 6), providing sufficient evidence for some workers to assign the formation to the Wilcox group. Likewise, other workers might place a disconformity, based on uneven erosional surface (fig. 3), at the base of the Carrizo, placing it in the Claiborne group.

Due to the sparsity of exposures of the contacts of the Carrizo, this writer was not able to ascertain which of the above two features was the more significant; therefore, the Carrizo formation has been mapped in the Wilcox group in Bossier Parish following the usage of most workers in Louisiana.

The Carrizo is exposed in two principal areas in Bossier Parish. The greater areal extent is around Fillmore and Haughton in T18N, R11W. A less extensive distribution of the Carrizo occurs from the area west of Benton north along the Red River to section 14, T21N, R14W, just south of the Egypt Hill community. In the SE$\frac{1}{4}$, SW$\frac{1}{4}$, section 11, T21N, R14W, exposed in a cut on the east side of an oil field road just west of Egypt Hill, undifferentiated lower Claiborne glauconitic clays rest directly on undifferentiated Wilcox sands and clays.

The Carrizo ranges in thickness from zero just west of Egypt Hill to a maximum calculated to be over 88 feet near Cypress Lake in section 13, T20N, R14W. The formation is 25 to 40 feet thick in the Sligo oil field area southwest of Fillmore and thins toward the Bellevue dome to about 5 feet in section 5, T18N, R11W, 0.75 mile north of Fillmore on state highway 157. The average thickness of the Carrizo in the Haughton-Fillmore area is 10 feet. Numerous bore holes were drilled in this area to establish the thickness of the formation.

The thickest section of the Carrizo found in Bossier Parish was near the south end of Cypress Lake in section 13, T20N, R14W. Thirty-five feet of Carrizo sand is exposed along the north slope of the hill just southeast of the lake. Bore hole 57-23 was drilled at the north end of this slope along the highway and penetrated Carrizo sand to a depth of 53.5 feet, making a total of at least 88.5 feet for the formation at this point. This bore hole bottomed in Carrizo sand so the actual thickness is not known. The sand thins northward from this area and pinches out somewhere south of Egypt Hill. Bore hole 57-5 was drilled 0.5 mile south of the Cedar Bluff crossroad in section 25, T21N, R14W, approximately 3 miles southeast of Egypt Hill. The Carrizo was 6 feet thick in this hole.

Along state highway 162 one mile west of Benton, 20 feet of Carrizo sand is exposed in a road cut on a low hill above the Prairie terrace. The hill is capped by weathered, red-brown, glauconitic sand and glauconite of the basal Claiborne. A few hundred yards to the east the Carrizo is covered by the Prairie formation on which the town of Benton is located.

The Carrizo dips approximately 50 feet per mile east in the Sligo oil field area and 50 to 60 feet per mile southeast around Fillmore and north of U. S. Highway 79-80.

The presence of one and possibly two high Pleistocene deposits in the Sligo oil field area served to confuse mapping of the Carrizo. It was very difficult at times to distinguish between Tertiary sand and Pleistocene sand. An example of this problem occurs 0.75 mile north of the Sligo oil field office in the W$\frac{1}{2}$, SW$\frac{1}{4}$, SW$\frac{1}{4}$, section 29, T18N, R11W. An exposure of very coarse, angular quartz sand occurs a few feet east of the gravel road in a low bank. Sand of a similar nature was found in bore hole 57-38, drilled in the Prairie formation west of Clarke Bayou. This exposure occurs at an elevation which fits the dip of the Carrizo from the higher terrain on the west but is like no Carrizo seen elsewhere in Bossier Parish; therefore, it has been mapped as "undifferentiated terrace deposits". This problem is mentioned herein to explain the possibility of some inconsistency in mapping the Carrizo in this area.

No fossils were found by this writer in this formation in Bossier Parish. Many bore hole samples were examined for microfossil content but, if fossils did exist, leaching has removed all evidence.

Claiborne Group

Different names are applied herein to the sediments of the lower Claiborne interval in Bossier Parish. In central and southeastern Bossier Parish the undifferentiated sediments of this interval, from the top of the Wilcox to the base of the Sparta, are mapped as the "undifferentiated lower Claiborne". In northwestern Bossier

Fig. 3. Uneven erosional contact between the Carrizo sand and undifferentiated Wilcox, center SW$\frac{1}{4}$, sec. 20, T18N, R11W, 1.55 miles west of Haughton on the Illinois Central R.R.

Fig. 4. Borings in the top of the Carrizo sand 0.7 mile north of Fillmore on state highway 157, section 5, T18N, R11W.

Parish this inverval is divided into three formations which have been correlated by Smith[5] on electrical logs with the Reklaw, Queen City and Weches formations of the southern half of the Tyler Basin, East Texas. Occurring stratigraphically above this interval is the Sparta formation which is overlain by the Cook Mountain formation.

Reklaw Formation

The Reklaw formation, the lower shale unit of the lower Claiborne of northwestern Bossier Parish, has been recognized at only one locality in the parish. At Coushatta Bluff in SE$\frac{1}{4}$, SE$\frac{1}{4}$, SW$\frac{1}{4}$, section 35, T22N, R14W, the Reklaw-Queen City contact is visible 25 feet below the top of the bluff. Plate 9 shows the relationship of the Red River bluffs from this point north to Dutch John Bluff in section 26 of the same township. South of Coushatta Bluff the river bank is covered by alluvium and no Reklaw lithology is seen. Bore hole 57-58 was drilled a few hundred feet east of the top of Coushatta Bluff to determine the lithology stratigraphically below the base of the bluff. This hole was drilled to a depth of 63.5 feet and bottomed in fossiliferous, lignitic Reklaw shale. Although shell fragments of pelecypods and gastropods were present in the cuttings, no microfossils were found in the washed samples from this hole or from bore hole 58-1, 0.6 mile to the south.

At Coushatta Bluff some 25 feet of the Reklaw is exposed at low-water level of the Red River. The dominant lithology is glauconitic,

[5] Smith, _op. cit._, p. 2519.

lignitic, micaceous, interbedded sand and clay with abundant gypsum crystals along the bedding planes. The section at this bluff was described by Veatch[6] in 1898. On the basis of fossils observed in these sediments, he considered the section to be of lower Claiborne age. A large collection of fossil plants was made here by Veatch. This flora was included in reports of Hollick[7] and Berry[8]. No plant fossils were found by the present writer in his measurement and description of this bluff section.

A few hundred yards south of the main portion of Coushatta Bluff an extremely fossiliferous sand, 6 inches to 1 foot thick, is exposed at low water of the Red River. This sand, within the Reklaw, lies 6.0 feet below a concretionary clay-ironstone ledge which caps a low bank of cross-bedded, lignitic shale and glauconitic sand. The sand itself is almost black with disseminated lignite and contains a large quantity of shell impressions, none of which could be preserved for study due to the extreme friability of the sand when dry. Species of the pelecypod genera _Nucula_, _Nuculana_, _Yoldia_ and _Venericardia_, among others, are present in this sand.

The thickness of the Reklaw cannot be determined from surface information but is revealed on electrical logs of wells in the area. A well in section 10, T22N, R14W shows a thickness of 120 feet. In northeastern Caddo Parish the formation is some 100 feet thick. The

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[6] Veatch and Harris, _op. cit._, p. 200

[7] Hollick, _op. cit._

[8] E. W. Berry, _Lower Eocene Floras of Southeastern North America_, U. S. Geol. Surv. Prof. Paper 91 (1916), p. 56.

Reklaw is 125 to 140 feet thick in the subsurface of northeastern Bossier Parish (plate 8).

Queen City Formation

In Bossier Parish the lower Claiborne sediments lying between the Reklaw and Weches formations have been correlated by Smith[9] with the Queen City formation of the southern half of the Tyler Basin, East Texas. This formation consists of three members, the lower Arp sand member, the middle Omen glauconitic shale member, and the upper Myrtis sand member. These members have been traced on electrical logs through Caddo Parish and into north central Bossier Parish where, according to Smith,[10] the sand members pinch out and the formation cannot be separated from the Reklaw beneath and the Weches above. The subsurface correlations (plate 8) made by the present writer show the upper sand member, the Myrtis, to continue into western Webster Parish. The three members of the Queen City are exposed along the east bank of the Red River from Coushatta Bluff to Dutch John Bluff in T22N, R14W (plate 9).

The lower member, the Arp, is a 25 to 30 foot unit of lignitic, glauconitic, fossiliferous quartz sand exposed at the top of Coushatta Bluff, at Silver Lake Bluff in the NE$\frac{1}{4}$, NW$\frac{1}{4}$, section 35, and at DEJ Locality 60, SE$\frac{1}{4}$, SW$\frac{1}{4}$, section 26 (plate 9). A very irregular black shale lens occurs in the middle of the sand at Coushatta

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[9] Smith, _op. cit._, p. 2518.

[10] _Ibid._, p. 2519.

Bluff and is recognized at the other sections mentioned above. At Silver Lake Bluff the shale occurs as an interfingering unit within the Arp, dividing it into an upper and a lower sand. At this point the Arp is strongly cross-bedded, quite lignitic and glauconitic, and contains abundant pelecypod impressions. The upper sand stringer, about 1 foot thick at the north end of this bluff, is present at DEJ Locality 60 some 5 feet below the crest of the waterfall. The Arp member has been traced on electrical logs in the subsurface east of the Red River approximately 10 miles where it pinches out (plate 8).

The middle member of the Queen City, the Omen, is best exposed on the upper part of Silver Lake Bluff, at DEJ Locality 60, 0.25 mile to the north, and around the base of Dutch John Bluff where it consists of 26.2 feet of glauconitic, chocolate-brown clay, glauconite and sideritic ironstone. No fossils were found in this unit.

The upper sand member of the Queen City was unnamed until Smith[11] in 1958 introduced the name "Myrtis" for exposures near the community of the same name in Caddo Parish. In Bossier Parish the Myrtis member is best exposed along the upper part of Dutch John Bluff where it is a relatively clean, cross-bedded quartz sand 26.7 feet thick, lying beneath the glauconitic clay and ironstone of the Weches formation. The Myrtis member has been traced on electrical logs in the subsurface of northern Bossier Parish to the Webster Parish line where it is some 15 feet thick (plate 8).

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[11] *Ibid.*, p. 2520.

The sand members of the Queen City pinch out just southeast of Coushatta Bluff, and the remaining section, the Omen member, is not distinguishable from overlying and underlying lithologies in central and southeastern Bossier Parish.

Weches Formation

The Weches formation has been identified in only two restricted areas of Bossier Parish. Red glauconitic clay and ironstone of this unit occurs at the top of Dutch John Bluff (plate 9) and east and southeast in the vicinity of the Gilmer Hill School. The other area of outcrop of the Weches is at Millers Bluff in section 10, T22N, R14W where 25 to 30 feet of glauconitic shale and ironstone is exposed at low-water level of the Red River. Bore hole 57-36 was drilled at the foot of this bluff and encountered at a depth of 12 feet a sand which this writer considers to be Myrtis. A total thickness of 42 feet was calculated for the Weches at this point. This figure agrees very closely with the thickness determined from electrical logs of wells a few miles to the east.

A few genera of arenaceous Foraminifera were found in the sediments at Millers Bluff. No megafossils were found in this formation in Bossier Parish.

Undifferentiated Lower Claiborne

The term "undifferentiated lower Claiborne" is applied herein to the majority of the sediments of the lower Claiborne interval in Bossier Parish. In northwest Bossier Parish this interval has been divided into three formations which already have been discussed. This separation is not possible on the surface southeast of T21N, R14W and the lower Claiborne interval becomes an undifferentiated unit of glauconitic, chocolate-brown clays and sands 220 to 300 feet thick.

This interval was mapped as Cane River by Martin[12] in Webster Parish to the east. The term "Cane River" is not applied to these sediments in Bossier Parish for several reasons. The Cane River formation was described by Spooner[13] in 1926 as follows:

> In the Cane River are included the 75-150 feet of beds above the Wilcox (Sabine) formation and below the massive Sparta sand. The name Cane River, from the excellent exposures on the Cane River at Natchitoches, Louisiana, was suggested by H. V. Howe.
>
> These beds outcrop in a narrow belt extending northeast across southern Sabine and Natchitoches parishes. A few miles east of Red River the strike changes to northwest and continues in that direction to the Arkansas line. The width of outcrop is 3-7 miles.
>
> An erosional unconformity separates the Cane River and Wilcox (Sabine) beds. The basal member consists of glauconitic sand and sandy clay, but in some places marine tuff is present at the base. Glauconitic clays predominate in the southern portion of the outcrop but northward from Bienville Parish they become sandier, until, in northern Bossier Parish they are represented by sands, in part glauconitic, and containing a meager representation of the prolific fauna found farther south.

In 1930 Shearer[14] subdivided the Cane River into the Cane River marl below and the Cane River clay above. These were described as follows:

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[12] Martin, op. cit., geological map.

[13] W. C. Spooner, "Interior Salt Domes of Louisiana", Bull. Am. Assoc. Pet. Geol., vol. 10 (1926), p. 235.

[14] H. K. Shearer, "Geology of Catahoula Parish, Louisiana", Bull. Am. Assoc. Pet. Geol., vol. 14 (1930), pp. 439-441.

> The top of the upper member is sandy shale which grades downward into smooth, plastic, slightly calcareous clay-shale. This material is characterized by its dark chocolate-brown color, generally specked and streaked with light green. It is all marine, and Foraminifera are plentiful.
>
> The lowest member consists of fossiliferous sandy, highly glauconitic marl or soft limestone. It is commonly logged as "salt and pepper" sand because of the appearance of the white limestone with grains of dark glauconite.

In Bossier Parish the sediments of this interval bear little resemblance to the lithology of the Cane River in areas to the south and east. In Bossier Parish these sediments are lignitic, glauconitic clays and sands, 220 to 300 feet thick, carrying a meager microfauna. These sediments possibly represent a depositional environment much closer to the Claiborne shoreline and constitute the more clastic, near-shore facies of the lower Claiborne.

At its type locality in Natchitoches Parish, the Cane River has a zone of *Ostrea lisbonensis* some 50 feet[15] below the top of the formation, leaving a 25 to 100 foot section of Cane River below the zone. In Bossier Parish only two specimens of this fossil were found at one locality near the Bayou Bodcau dam in section 28, T20N, R11W. The interval between the top of the Wilcox group and the base of the Sparta formation in this vicinity is about 220 feet as determined from electrical logs of wells in the area. The interval between the base of the Claiborne and the occurrence of *Ostrea lisbonensis* at Bayou Bodcau is about 180 feet, considerably more than that of the Cane River type locality. As far as known by this writer, *Ostrea lisbonensis* has been reported only from the Weches. The correlation

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[15] H. V. Andersen, 1958, personal communication.

of this interval from Bossier Parish to Natchitoches Parish has not been established. It is not known whether the type Cane River is also equivalent to the Reklaw.

In 1929, Wendlandt and Knebel[16] divided the Mount Selman formation into the Carrizo, Reklaw, Queen City and Weches formations in Texas. According to Howe,[17] this was a "sub-stage" usage of the term.

On the 1937 geological map of Texas,[18] the Reklaw, Queen City and Weches "members" are included in the Mount Selman formation; consequently, the term "Mount Selman" has been used both as a sub-group and as a formation and, to avoid confusion, it is not used in Bossier Parish by this writer.

In Bossier Parish the undifferentiated lower Claiborne consists of 220 to 300 feet of sparsely fossiliferous, glauconitic, lignitic, interbedded sands and clays with rather abundant sideritic ironstone. Lignite is common and occurs as disseminated particles and thin stringers. Rapid facies changes are common in the more lignitic parts of the formation.

In Bossier Parish the formation crops out in an interrupted belt from Haughton in T18N, R11W northwest to a fault in the Gilmer Hill community of T22N, R14W, and dips northeast at 40 to 50 feet per mile along the outcrop. This amount of dip decreases to some 15 to 25 feet per mile in the subsurface of the northern portion of the parish.

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[16] E. A. Wendlandt and G. M. Knebel, "Lower Claiborne of East Texas with Special Reference to the Mt. Sylvan Dome and Salt Movements", Bull. Am. Assoc. Pet. Geol., vol. 13 (1929), p. 1351.

[17] Howe, _op. cit._, pp. 622-623.

[18] N. H. Darton and Others, Geological Map of Texas, 1:500,000, U. S. Geol. Surv., (1937).

The same decrease is apparent on the subsurface contour maps of the parish (plates 2 and 3).

Exposures of the lower glauconitic clays and ironstones of the formation occur along U. S. Highway 79-80 between Giddens' Hill in section 8, T18N, R11W and Clarke Bayou in section 10 of the same township. The contact of the Claiborne with the underlying Wilcox is present a few hundred feet south of Fillmore on state highway 157 (plate 6). This contact has been discussed on page 29. Massive glauconites are exposed in a shallow borrow pit 100 yards east of this road cut.

North of Fillmore the lower Claiborne glauconites and clays are exposed for a distance of 0.7 mile. Wilcox sediments crop out from this point north to Bayou Bodcau in T20N, R11W. Excellent sections of the upper glauconitic clays and glauconites of the undifferentiated lower Claiborne are present along the south side of the bayou from the dam in section 28 southwest to sections 29 and 32 where the belt is interrupted by a normal fault one mile north of the community of Bellevue. An isolated exposure of glauconitic clay was found north of the bayou around the base of a hill, the top of which is capped by Prairie deposits, in sections 19 and 30, T20N, R11W and sections 24 and 25, T20N, R12W.

Along most of the outcrop, the undifferentiated lower Claiborne is about 220 feet thick. The unit reaches a maximum thickness of 300 feet in the subsurface of northeastern Bossier Parish.

The area around Bayou Bodcau was the only one in Bossier Parish at which well-preserved Claiborne fossils were found. Approximately one-fourth of a mile southwest of the south end of the dam in sections 28 and 29, T20N, R11W, dark-green, fossiliferous, glauconite boulders rest on the surface. These boulders were removed from the large borrow pit during the construction of the dam and carry a thin, very fossiliferous zone in which were found pelecypods, gastropods and scleractinian corals. Two valves of Ostrea lisbonensis were found 200 feet southeast of the dam, a few yards west of the gravel road which crosses the base of the Bodcau Fire Tower hill in the NW$\frac{1}{4}$ of section 28. A series of bore holes drilled by the U. S. Army Corps of Engineers for the damsite investigations revealed the best microfauna found by the writer in Bossier Parish. Bore hole T-31, E$\frac{1}{2}$, NW$\frac{1}{4}$, section 28, T20N, R11W, was drilled to a depth of 103 feet in the undifferentiated lower Claiborne. From 64 feet to 94 feet, the samples from this hole, top elevation 200 feet, yielded the following Foraminifera and Ostracoda:

Anomalina costiana Weinzierl and Applin
Cibicides hypoconoides Hussey
Cibicides mauricensis Howe and Roberts
Cibicides sp.
Cyclammina caneriverensis Hussey
Eponides mexicana (Cushman)
Globigerina cretacea d'Orbigny
Globigerina sp.
Globulina sp.
Globulina gibba d'Orbigny
Gümbelina sp.
Guttulina sp.
Gyroidina soldanii d'Orbigny var. octocamerata Cushman and Hanna
Haplophragmoides sp.
Lamarckina clairbornensis (Cushman)
Robertina sp.
Siphonina claibornensis Cushman
Siphonina sp.
Siphoninella chambersi Howe and Roberts
Textularia zapotensis ? Cole
Uvigerina blanca-costata Cole
Uvigerina sp.

<u>Buntonia alabamensis</u> (Howe and Pyeatt)
<u>Haplocytheridea wallacei</u> (Howe and Garrett)
<u>Haplocytheridea</u> sp.

No microfossil zonation was found possible in the lower Claiborne interval in Bossier Parish. Numerous bore hole samples were examined for microfossil content and were found to be lacking most of the species listed above. Why this particular area yielded such a fauna is not known.

The following fossil genera were identified by the writer from the undifferentiated lower Claiborne sediments at Bayou Bodcau in sections 28 and 29, T20N, R11W:

Pelecypoda: <u>Corbula</u>, <u>Nucula</u>, <u>Nuculana</u>, <u>Ostrea</u>, <u>Tellina</u>, <u>Yoldia</u> and <u>Venericardia</u>.

Gastropoda: <u>Architectonica</u> and <u>Turritella</u>

Scaphopoda: <u>Dentalium</u> and <u>Cadulus</u>

Anthozoa: <u>Turbinolia</u> and <u>Endopachys</u>

Bryozoa: <u>Lumulites</u>

Casts and molds of some of these genera occur commonly in ironstone concretions at other localities in the undifferentiated lower Claiborne of Bossier Parish. The best locality for these genera, <u>Corbula</u>, <u>Venericardia</u> and <u>Architectonica</u>, is a small borrow pit in the NE$\frac{1}{4}$, NW$\frac{1}{4}$, NE$\frac{1}{4}$, section 19, T20N, R12W a few hundred feet south of state highway 162. The fossils occur in the indurated, glauconitic, ledges at this locality.

Harris[19] reported <u>Crassatellites trapaquarus</u> from "Fillmore 2 miles W. of Houghton, La." Fillmore, located in the outcrop of the

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[19] G. D. Harris, <u>Pelecypoda of the St. Maurice and Claiborne Stages</u>, Am. Paleo. Bull. 6 (1919), p. 96.

undifferentiated lower Claiborne, is 2.0 miles north-northwest of Haughton.

Sparta Formation

In Bossier Parish the Sparta formation strikes northwest and dips northeast at approximately 35 feet per mile along the outcrop. This dip decreases in the subsurface of northern Bossier Parish to 15 to 20 feet. The Sparta is exposed from the center of T20N, R12W northwest to Millers Bluff in T22N, R14W. A limited exposure occurs near the Bayou Bodcau dam in section 28, T20N, R11W. On the Bodcau Fire Tower hill some 30 feet of white, loose, Sparta sand overlies glauconitic clays and ironstones of the undifferentiated lower Claiborne.

The Sparta formation in Bossier Parish consists of a basal massive to cross-bedded, generally lignitic, quartz sand 120 to 150 feet thick, overlain by an equal thickness of interbedded sand and clay with occasional lignite stringers and sideritic ironstone ledges. The Sparta is 220 to 240 feet thick in the area around Plain Dealing in T22N, R13W and increases to some 400 to 500 feet in the Minden syncline of western Webster Parish. The thickest section of Sparta in the parish occurs in the South Sarepta oil field where 350 feet is present.

Excellent exposures of the upper Sparta interbedded sands and clays are seen along the approach roads to the community of Rocky Mount in section 17, T21N, R12W and between Rocky Mount and Plain Dealing along state highway 157 (fig. 6).

The basal massive to cross-bedded sands of the formation are exposed best east and northeast of the Benton cycling plant in sections 5, 6, 7 and 8, T20N, R12W. The hills in the area are composed of light-red to white, massive to strongly cross-bedded quartz sand. This topography stands some 120 feet above the Prairie terrace to the east.

The contact of the Sparta with the underlying undifferentiated lower Claiborne is indistinct in most areas due to colluviation of the sand over the upper part of the underlying unit. Where the contact is visible in road cuts, there appears to be a gradual change from the interbedded sands and clays of the undifferentiated lower Claiborne into the slightly clayey sands of the Sparta. In places this contact is marked by the development of ironstone ledges formed by the precipitation of iron from ground water when it strikes the relatively impermeable sediments of the underlying unit. At one locality in the parish, 0.6 mile southeast of Caney Creek at the base of a deep road cut in section 6, T20N, R12W, the Sparta is channeled into light-gray, non-glauconitic clay of the undifferentiated lower Claiborne. Bore hole 56-9 was drilled just below this contact (fig. 5) and passed through 43.5 feet of silty, non-glauconitic, chocolate-brown clay with thin, yellow quartz sand stringers.

The Sparta formation is an important fresh-water aquifer in Bossier Parish as well as other areas of north Louisiana. The lower massive sands of the formation carry relatively soft water which is free of the iron so common in sands of the Cook Mountain farther to the north and northeast.

No fossils were found by the writer in this formation in Bossier Parish.

Cook Mountain Formation

The Cook Mountain formation in Bossier Parish consists of interbedded, glauconitic sands and clays and fossiliferous, glauconitic ironstones attaining a thickness of 230 to 250 feet in the northern part of the parish. The upper contact of the formation is not present in Bossier Parish; therefore, exact thickness cannot be determined. It is 300 feet thick to the east in Webster Parish where the total thickness of the formation is present. The formation strikes northwest and dips northeast at 30 to 40 feet per mile although some local dips exceed this amount. In township 22 north the dip decreases to 15 to 25 feet per mile.

The Cook Mountain outcrop belt covers an area from Rocky Mount in T21N, R12W northwest to Plain Dealing and the Arkansas state line and north to Redland in T23N, R12W.

The Cook Mountain terrain constitutes the "redland" portion of Bossier Parish and consists primarily of strongly oxidized glauconitic sands, sideritic ironstones and chocolate-brown to gray clays with some plant remains. Current ripple marks are commonly preserved in the flaggy ironstone ledges (fig. 7). Most exposures are deeply weathered, and unaltered glauconite is rare, except in bore hole samples. The rocks are quite resistant to erosion and form a cap for the higher ridges and hills throughout their areal extent. The

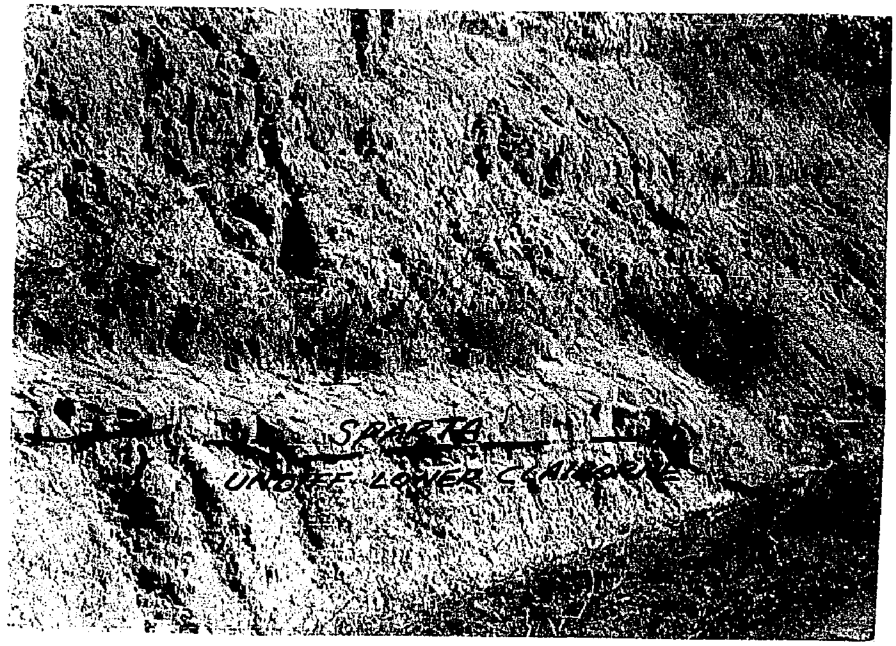


Fig. 5. Channel contact between the undifferentiated lower Claiborne and Sparta formations, 0.6 mile southeast of Caney Creek, section 6, T20N, R12W.

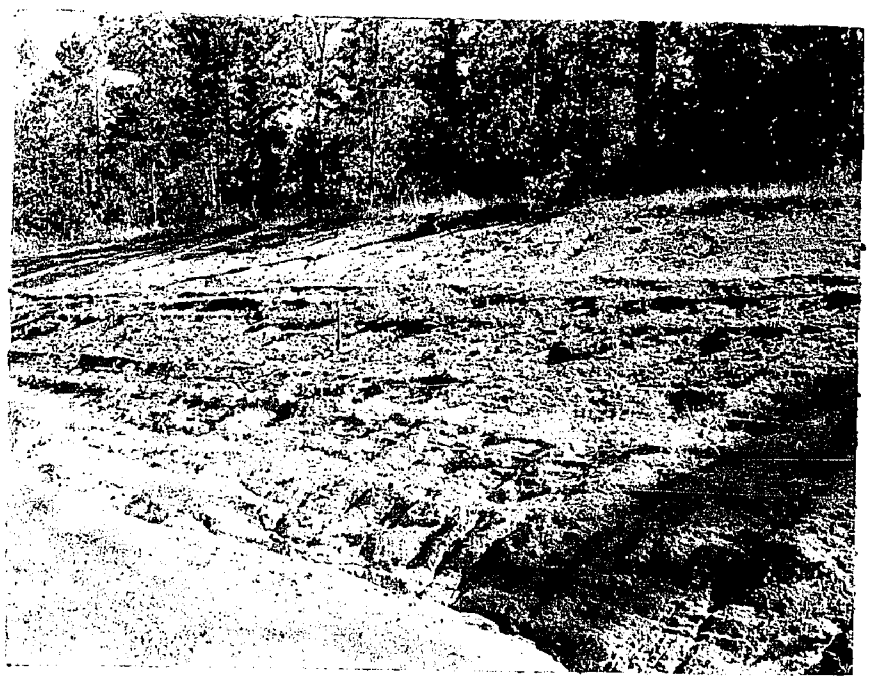


Fig. 6. Interbedded sand and clay of the upper part of the Sparta formation, 0.5 mile west of Rocky Mount on state highway 160.

highest topography in Bossier Parish is developed on rocks of this formation northwest of Plain Dealing where elevations in excess of 460 feet occur in T23N, R13W.

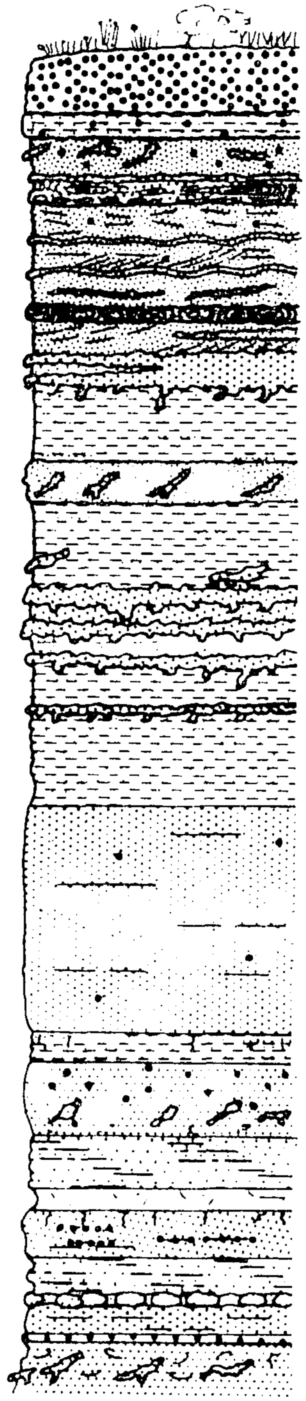
The best section of the Cook Mountain formation found in the parish was exposed in 1955 in a series of road cuts along state highway 2, 2.5 miles west of Plain Dealing. The preserved thickness of the Cook Mountain at this point is 140 feet as measured from the top of the Sparta formation to the top of the road cut adjacent to the old Ford Church. This series of cuts has been sodded over completely by state highway personnel and very little of the section is now visible. Plate 10 shows the columnar section and the east-west profile of the Cook Mountain and Sparta formations as exposed at this locality. The dip of the units at this locality is $2\frac{1}{4}$ to 3 degrees eastward but this is thought to be due to a fault which has been mapped just east of the road cut at the old Ford Church.

Excellent exposures of the Cook Mountain glauconitic sands and ironstones occur northeast of Plain Dealing along state highway 157 to Redland. The terrain is quite hilly, and the road cuts expose typical Cook Mountain lithology. A composite measured section is shown on plate 11 to illustrate the typical lithology of the formation. Portions of this section are strongly bored with some borings reaching a length of 18 inches. A fossil cast found approximately 50 feet above the base of this measured section was questionably identified as Ostrea sellaeformis. Numerous fossil casts and molds occur within this section, but they are difficult to extract. Glauconite is generally common but has weathered so strongly in places that

LOCALITY 72

STATE HIGHWAY 157, 2.5 MILES NORTHEAST OF PLAIN DEALING IN SECTIONS 2, T22N, R13W AND 35, T23N, R13W.

10 ft.



GLAUCONITE, cly., weathered into an irregular mass of concretionary ironstone ledges.

SAND and CLAY, indurated, glauconitic.

SAND, slty., yellow to red, indurated with borings throughout, glauc. ironstone ledge at base.

SAND, cly., cross-bedied in places, strongly indurated to irregular concretionary ironstone with some weathered glauconite.

CLAY, sdy., gray to red-brn., non-glauconitic, essentially without borings.

SAND, v. fine-grained qtz., cly., with some glauconitic ? borings.

CLAY, sdy., gray to reddish with 2-4" glauc. borings near base.

SAND, with interbedded sand and clay, with three well-developed, bored, concretionary ironstone ledges, irregular in nature.

SAND, red-brn. and CLAY, gray, interbedded, with a strongly bored ironstone ledge at base.

SAND and CLAY, interbedded, non-glauconitic with limonitic ledges.

SAND, v. fine to fine qtz., mustard-yellow to red-brn., massive to thinly bedded with some gray clay interbeds, numerous ripple-marked ironstone ledges, some weathered glauc.

CLAY and SAND, interbedded, with small, glauc. borings.

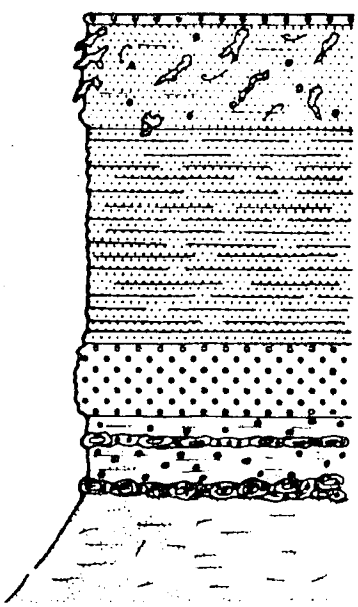
Ostrea sellaeformis ?

SAND and CLAY, interbedded, partially indurated, glauc., fossil casts in top 1.0'.

SAND, fine-grained qtz., with thin clay-glauc. stringers.

SAND and CLAY, interbedded, non-glauconitic.

SAND, v. fine to fine qtz., weathered yellow-brn., with large borings throughout, casts and molds of Modiolus texanus Gabb.



SAND, fine-grained qtz., and CLAY, slty., interbedded, non-glauconitic.

GLAUCONITE, fine-grained, massive, red-brn. to yellow-red.

CLAY, olive-green, with irregular pockets of v. fine qtz. sand, highly glauconitic.

Colluviated sdy. clay and cly. sand.

LOCALITY 74

STATE HIGHWAY 157, 2.1 MILES NORTHEAST OF PLAIN DEALING IN SECTIONS 2 AND 10, T22N, R13W.

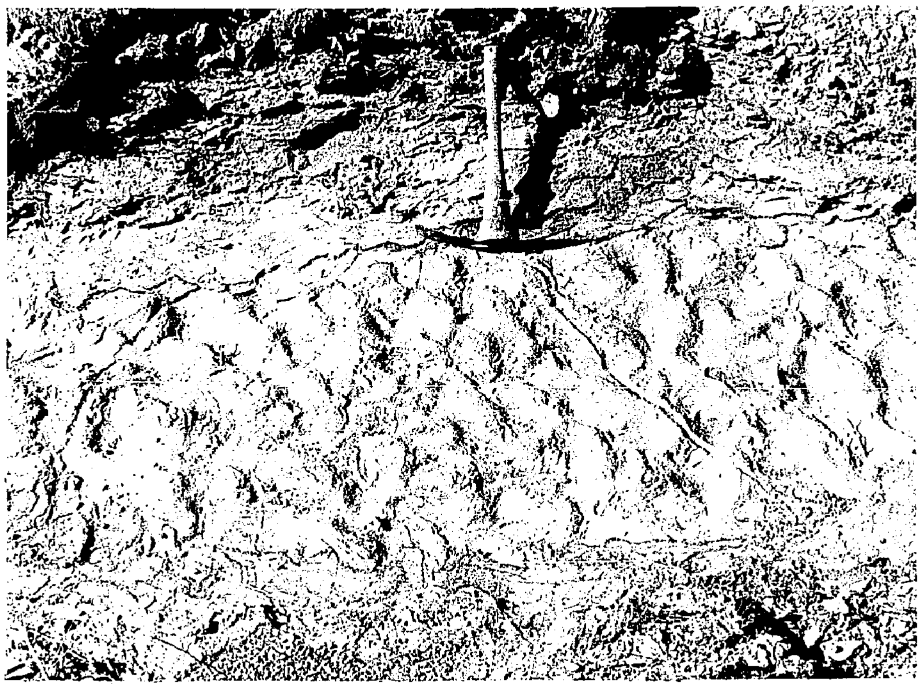


Fig. 7. Ripple-marked flaggy ironstone ledge, DEJ Locality 72, approximately 1.75 miles northeast of Plain Dealing on state highway 157, section 2, T22N, R13W.

only traces remain.

The basal glauconitic sands and ironstones of the formation are exposed along the approach roads to the community of Rocky Mount in section 17, T21N, R12W. The base of the Cook Mountain has been picked at the base of the first persistent glauconite or glauconitic ironstone above the interbedded sand and clay of the Sparta formation.

Some difficulty has been experienced in selecting the base of the Cook Mountain in parts of Bossier Parish. Locally the basal part of the formation consists of a slightly glauconitic sand which does not weather to a conspicuous ironstone. Four-tenths of a mile north of Rocky Mount in front of an abandoned frame house in the SW$\frac{1}{4}$, SW$\frac{1}{4}$, section 8, T21N, R12W two 5 to 8 inch ironstone ledges are exposed in the ditch north of the gravel road. These ironstones, almost metallic in appearance, lie 65 feet below the base of the glauconitic ironstone and sand exposed at the crest of the hill 0.15 mile north of the crossroads at Rocky Mount. These ledges were included within the Sparta formation inasmuch as they are sporadically distributed and not dependable for mapping and are overlain by a thickness of sand more logically placed within the Sparta.

The glauconitic units of the Cook Mountain, as well as the undifferentiated lower Claiborne, are variable in thickness and glauconite concentration so that a persistent ironstone is not present throughout the outcrop. At Rocky Mount the base of the formation is quite distinct, but in other areas, such as the contact 0.9 mile west of Plain Dealing on state highway 2, the lowermost glauconitic sand of the formation is barely recognizable.

The glauconites of the Cook Mountain occur in a variety of grain sizes and shapes concentrated in lenticular masses or disseminated as individual grains in the sands and clays. The types of glauconite and their possible origin are discussed by Martin[20] and Burst.[21]

A thick bed of glauconite is well-exposed northwest of Redland in the NE$\frac{1}{4}$, section 30, T23N, R12W. Exposed down the north slope of the

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[20]Martin, op. cit., pp. 100-101.

[21]J. F. Burst, "'Glauconite' Pellets: Their Mineral Nature and Applications to Stratigraphic Interpretations", Bull. Am. Assoc. Pet. Geol., vol. 42 (1958), pp. 310-325.

hill in the road cuts is some 40 feet of olive-green to blue-black glauconite which assumes a spheroidal appearance near the top of the hill (fig. 8). Apparently the pillow-like nature of the darker material is due to weathering and chemical hydration since the fresh glauconite exposed in borrow pits at the base of the hill is without concentric structure and is a light olive-green color. This is the thickest single accumulation of glauconite found in the parish and probably represents a lagoonal-type deposit because the thickness does not extend far in any direction.

Fig. 8. Cook Mountain glauconite, exhibiting spheroidal weathering, exposed 1.5 miles northwest of Redland in section 30, T23N, R12W.

In eastern Bossier Parish, the upper part of the preserved Cook Mountain consists largely of quartz sand, in part glauconitic, and thin, glauconitic ironstone ledges. Plate 12 shows a measured section along the north slope of the Plain Dealing Fire Tower hill in

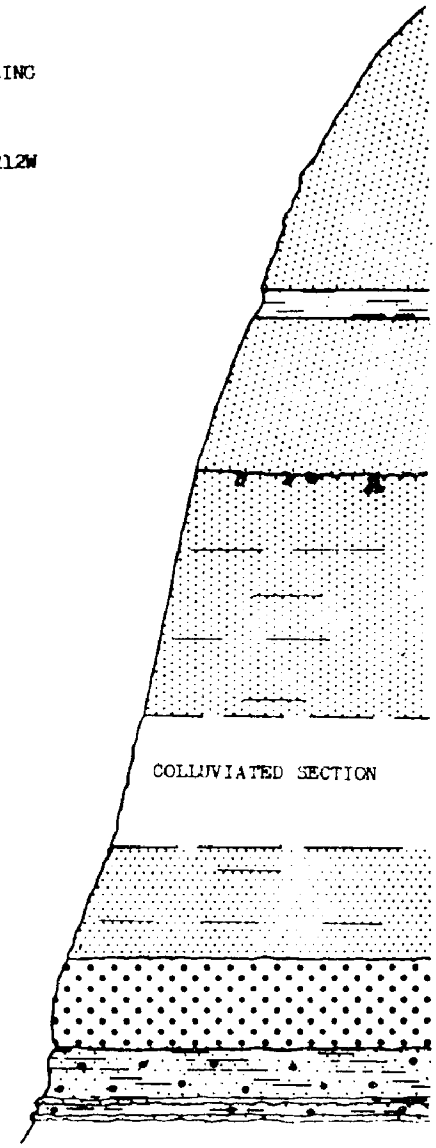
MEASURED SECTION

NORTH SLOPE, PLAIN DEALING

FIRE TOWER HILL

SECTIONS 15 & 16, T22N, R12W

10 ft.



SAND, fine to medium-grained qtz., red to yellow-brn., with numerous ironstone ledges, masses and concretions.

SAND, as above but yellow to reddish with glauconitic ? limonite borings at base.

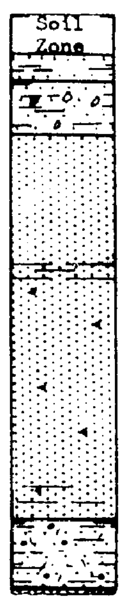
SAND, poorly laminated with light-gray leached, silty clay.

SAND, as above but with numerous thin ironstone laminae and ledges in lower six inches.

GLAUCONITE, medium-grained, sandy, da green-brown.

SAND, CLAY AND IRONSTONE, glauconitic irregular in nature.

Bore Hole
57-6



SAND and CLAY, interbedded, non-glauconitic with ironstone fragments.

SAND, v. fine-grained qtz., clayey, mod. glauconitic, angular.

CLAY, gray, silty, glauc. and micaceous.

T.D. 43.5'

Hole Located 0.4 miles North of Measured Section in Borrow Pit 100 ft. North of State Highway 2.

Top Hole Elevation 257' (Topo)

PLATE 12

sections 15 and 16, T22N, R12W. Bore hole 57-6 was drilled to determine the nature of the sediments stratigraphically below the lowermost glauconite ledge of the measured section. This hole was drilled at the base of this same ledge as traced on the surface north of state highway 2.

An exposure of glauconitic clay and ironstone along a normal fault in the Millers Bluff oil field in section 10, T22N, R14W has been mapped by the writer as Cook Mountain. The writer's interpretation of this area, formulated from surface and subsurface studies, leads to this formational designation. The principal fault, along which the clay is found, is exposed just north of the crest of the hill in the SE$\frac{1}{4}$ of section 10 in a low bank a few feet east of the gravel road to Wardview. North of the fault, down the hill toward the alluvial flat, the road cuts expose what is considered Sparta sand. This sand is too thick to be any of the Queen City sand members in this area. South of the fault for a distance of several hundred feet is exposed glauconitic clay and ironstone which is more apparent in the higher terrain to the west. Bore hole 57-31 was drilled at the crest of the hill at the east edge of the road a few yards south of the exposed fault plane. This hole penetrated some 20 feet of light-gray to white quartz sand before passing into black, clayey lignite which continued to the bottom at 43.5 feet. This amount of lignite was not observed by the writer elsewhere in either the Sparta or the Cook Mountain. It is very likely a local accumulation and, according to electrical log studies of wells in the vicinity, should be within the Cook Mountain. Bore hole 58-7, drilled about 1500 feet south of the fault near the site of the old Millers Bluff Church, penetrated 78.5 feet of sand which must be Sparta. This situation leads the writer to conclude that the glauconitic clay and ironstone on the south side of the fault is Cook Mountain and that its position is the result of downward movement to the south along this normal fault whose displacement is calculated to be some 120 feet. It is possible that this fault bounds the north side of a narrow graben but the south fault, if it exists, has not been found. A graben structure is present south of Hosston in Caddo Parish, and it may extend into the Millers Bluff area. The trace of the fault in the eastern half of section 10 is almost east-west but swings sharply southwest toward the river as indicated by bore holes in the southwestern part of the section.

Well-preserved fossils have not been found in this formation in Bossier Parish. Abundant casts and molds of pelecypods and gastropods are found locally in the glauconitic ironstones but, in most cases, specific identification was not attempted due to the lack of diagnostic features. Foraminifera are lacking generally in most samples on the surface, but some arenaceous forms are found in bore hole samples. The arenaceous genera are difficult to identify and serve little stratigraphic purpose. The prolific microfaunas reported by Howe[22] and Martin[23] from Bienville and Webster Parishes

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[22]H. V. Howe, Louisiana Cook Mountain Eocene Foraminifera, La. Geol. Surv. Bull. 14 (1939), 122 pp.

[23]Martin, op. cit., pp. 96-98.

were not found in Bossier Parish. Apparently during Cook Mountain time Bossier Parish lay nearer the shoreline than the areas to the south and east, producing an environment unsuitable for the abundant faunas found elsewhere in this formation.

The following pelecypods were identified by the writer from the Cook Mountain northwest of Plain Dealing at DEJ Locality 74, approximately 100 yards east of the entrance road to the Plain Dealing cemetery along the north side of state highway 157 in the NE$\frac{1}{4}$, NE$\frac{1}{4}$, NE$\frac{1}{4}$, section 10, T22N, R13W: Modiolus texanus Gabb, Ostrea sellaeformis ? Conrad and Venericardia planicosta Lamarck.

Harris[24] reported the following fossils from the Pope Joy Cut, NW$\frac{1}{4}$, SE$\frac{1}{4}$, section 3, T22N, R13W, on the St. Louis Southwestern Railroad between Plain Dealing and the Arkansas state line: Venericardia planicosta, Turritella mortoni, Cytherea nuttalli ?, Modiola texana and Tellina sp.

The following is quoted from the same page of this report by Harris:

> Still nearer Plain Dealing, only half a mile north of the station, small casts of Cytherea, Mactra, Sulcula, Dentalium, Nucula and Corbula were found in fragments of concretionary sandstone.
>
> Some distance to the northeast of these localities, 23N, 12W, section 19, southwest quarter, (Station 2416 of Museum register) several poorly preserved fragments of casts were found in ferruginous concretions. Among these were recognized Ostrea, Modiola texana, Tellina (gibbous), Mactra, Venericardia planicosta, Cytherea nuttalli ?, Surcula and Flabellum.

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[24] G. D. Harris, The Tertiary Geology of Southwest Arkansas, An. Rept. of the Ark. Geol. Surv. for 1892, vol. 2, p. 180.

> About 5 miles due south of this locality, (Station 2024, 23N, 12W, section 18) L. C. Johnson obtained in a ferruginous matrix, many casts of _Venericardia planicosta_, together with one specimen of _Astarte conradi_ Dana.

The township designation of this last locality of Harris is apparently incorrect. According to the description of this locality in relation to the previous one, it should read "T22N".

Harris[25] in 1919 listed the following fossils occurring in that part of Bossier Parish mapped (by the present writer) as Cook Mountain: _Ostrea alabamiensis_, found in form of casts 2.0 miles north of Plain Dealing;[26] _Modiolus texanus_, found near Redland in section 19, T23N, R12W;[27] _Cardium harrisi_, found near Redland in section 19, T23N, R12W;[28] and _Pteropsis lapidosa_, from near Redland, Bossier Parish.[29]

Quaternary System

Pleistocene Series

From oldest to youngest the Pleistocene terraces occupy successively lower topographic positions, each closer to the present level of its parent stream. The older terraces are more strongly oxidized and dissected than the younger terrace and tend to cap the higher elevations in isolated to moderately extensive exposures.

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[25] G. D. Harris, _Pelecypoda of the St. Maurice and Claiborne Stages_, Am. Paleo. Bull. 6 (1919), 268 pp.

[26] _Ibid._, p. 10.

[27] _Ibid._, p. 33.

[28] _Ibid._, pp. 131-132.

[29] _Ibid._, pp. 178-179.

The problem of mapping the Pleistocene deposits topographically above the Prairie terrace is rather acute in Bossier Parish, particularly in the outcrop of the Tertiary blanket sands. It is almost impossible to distinguish Pleistocene sand from Tertiary sand in some cases, especially when the base of the supposed Pleistocene is not visible. This writer feels that at least three different Pleistocene formations are present in Bossier Parish but the elevation of these deposits varies enough to make impossible a surface extension from one area to another. For this reason, all Pleistocene deposits occurring topographically above the Prairie terrace were mapped as "Undifferentiated Terrace Deposits".

Undifferentiated Terrace Deposits

Deposits mapped in this category occur at elevations ranging from about 220 feet to nearly 400 feet above sea level and are exposed in two principal areas of Bossier Parish. The area south of Haughton, west into the Sligo oil field and east toward Clarke Bayou, has rather extensive deposits of undifferentiated Pleistocene material. In sections 29, 30 and 33, T18N, R11W these deposits contain very coarse, angular quartz sand and granules throughout most of their thickness. An exposure of this sand has been discussed on page 33 of this report.

The area south, southwest and east of the community of Bellevue is covered with a Pleistocene deposit the upper level of which is 15 to 25 feet topographically above the Prairie terrace. This material consists almost exclusively of red to light-gray, silty sand with some coarse quartz fraction. This deposit is probably Montgomery in age but no definite basis exists for this designation except that the formation is the first found topographically above the Prairie level.

Southwest of Rocky Mount in the Sparta outcrop in section 19, T21N, R12W occurs a deposit of reworked ironstone gravel which is 95 feet higher topographically than the Prairie terrace one mile to the southeast. This gravel probably was derived from the Cook Mountain formation which is present at Rocky Mount. An area of several acres is covered with this material (fig. 9).

A high Pleistocene deposit containing chert gravel is located 0.4 mile north of Swindleville on state highway 3 in sections 20 and 21, T21N, R13W. The deposit, predominately medium-grained quartz sand, is only slightly graveliferous and rests on undifferentiated lower Claiborne glauconitic clay and sideritic ironstone at an elevation of about 300 feet. This elevation agrees with that of the ironstone gravel southwest of Rocky Mount, and the two deposits, even though lithologically different, may have been formed at the same time.

Prairie Formation

The Prairie formation in Bossier Parish consists of rather monotonous flat stretches of clayey sands and silts extending from the southern part of the parish north to the Arkansas state line. It tends to surround the Tertiary uplands and is recognized by its extreme flatness which is not seen commonly in the higher Pleistocene deposits.

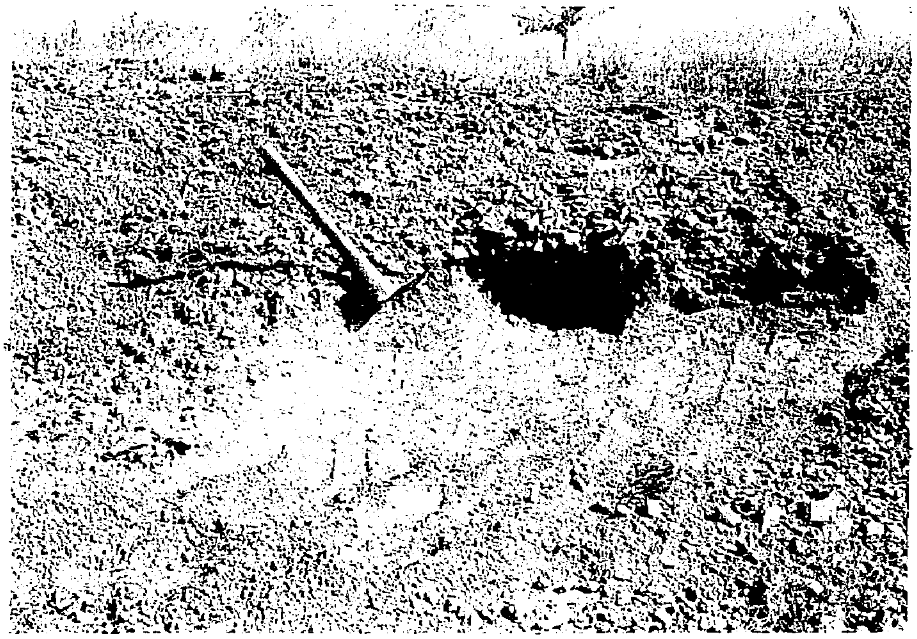

Fig. 9. Pleistocene ironstone gravel resting on Sparta sand, 1.5 miles southwest of Rocky Mount, section 19, T21N, R12W.

The most extensive deposits of the Prairie formation occur south and southwest of Haughton in T17N, R11W to the parish line. This surface extends north along Red Chute Bayou to Bayou Bodcau where Wilcox sediments are encountered. North of Bayou Bodcau the Prairie terrace extends north and east to the parish boundary. The Bellevue oil field in T19N, R11W is masked completely with Prairie deposits which extend east into Webster Parish where they were mapped as the Montgomery formation by Martin.[30] This terrace surface has been traced by C. O. Durham, Jr.[31] 100 miles downstream along the Red

[30] Martin, op. cit., geological map.

[31] C. O. Durham, Jr., 1958, personal communication.

River by use of topographic maps published since Martin's work. In Grant Parish it is found to form the terrace surface intermediate in level between the present flood plain and the type Montgomery terrace level described by Fisk;[32] therefore, it is interpreted to be the Prairie terrace level.

The slope of the Prairie surface in Bossier Parish is some 1.5 feet per mile to the south. A series of bore holes drilled by the U. S. Geological Survey in the area northwest of Lake Bistineau revealed a thickness of 90 to 100 feet for the Prairie formation. A 10 to 15 foot zone of chert gravel was found at the base of the formation in these holes.

In some areas the Prairie is difficult to differentiate from recent alluvium, particularly up the courses of the smaller streams where little incisement of the Prairie terrace has occurred. The recent streams tend to meander across this surface, making separation of Prairie and recent alluvium very difficult. In most cases this separation, where possible, was made with the use of aerial photographs.

The best exposures of the Prairie formation are along the east bank of Red Chute Bayou, 6 miles east of Bossier City along U. S. Highway 79-80. The Prairie escarpment rises 40 to 50 feet above the level of the Red River flood plain. Red Chute Bayou is flowing along the eastern side of the flood plain at the base of the escarpment. At

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[32] H. N. Fisk, <u>Geology of Grant and La Salle Parishes, Louisiana</u>, La. Geol. Surv. Bull. 10 (1938), pp. 56-57.

this point, the elevation of the flood plain is about 165 feet above sea level and the elevation of the Prairie surface is about 210 feet above sea level. At the southern limit of the town of Benton, along state highway 3, the level of the flood plain is 15 to 20 feet higher than at Red Chute, and the level of the Prairie terrace is a few feet lower than at Red Chute, reflecting differing elevations on these surfaces, depending on the position of natural levees of the trunk stream and back swamps.

The level of the tributary Prairie surface along Cypress Bayou is 12 to 16 feet lower than the Prairie terrace east and southeast of Rocky Mount. The same condition exists in the alluvial valleys of streams presently flowing into the Red River flood plain. During Prairie time, the tributary streams apparently did not alluviate as heavily as the trunk stream, forming deposits whose surfaces were lower than that of the trunk stream. The basal graveliferous part of the tributary Prairie of Cypress Bayou is exposed 100 yards northeast of Hughs Spur on the St. Louis Southwestern Railroad, approximately one mile east of Swindleville in the NE$\frac{1}{4}$, section 28, T21N, R13W. The elevation of the base of the Prairie at this locality is approximately 200 feet, some 15 to 20 feet lower than the upper surface a mile to the east. The thickness of Prairie fill in the valley of Cypress Bayou is not known. The Prairie occurs along both sides of Cypress Bayou from a point three miles south of Swindleville north to about the junction of Little Cypress Bayou in the northeastern part of T21N, R13W where recent alluvium cannot be distinguished from Pleistocene deposits on aerial photographs.

Recent Alluvium

Recent alluvium in Bossier Parish occurs primarily along the Red River in the western and southern parts of the parish. Lithologically it consists of sandy silts and clays with assorted vegetative debris attaining a thickness of 60 to 70 feet east of Bossier City. Bodcau and Cypress bayous have rather wide alluvial valleys, but the thickness of the alluvium is not known.

The width of the Red River flood plain itself reaches a maximum some 5 miles north of Shreveport where the river valley is about 13 miles wide. At this point in Bossier Parish, the Cypress Bayou and Bodcau Bayou alluvial surfaces meet the flood plain of the Red River, forming a large re-entrant at the mouth of the two bayous. The surface of the Bodcau Bayou flood plain is 3-10 feet lower than that of the Red River, causing a damming effect which diverts the water of the bayou south down the Red Chute course along the eastern edge of the Red River valley. This difference in elevation of the two alluvial surfaces is a likely cause for the formation of Lake Bodcau which once extended from this point northeast some 10 to 12 miles. The lake was considered by most early workers to have been formed by the famous Red River raft during the 19th Century. This raft, a jam of logs and other debris, once extended intermittently from Campti, Natchitoches Parish, to a point some 5 miles north of Millers Bluff, Bossier Parish. At the time of the final clearing of the raft in 1873, it extended from Carolina Bluff, northwest of Benton, Bossier Parish, north to its head near Millers Bluff, an airline distance of approximately 16 miles.

Approximately two miles northwest of Benton the Red River cuts against Tertiary sediments and forms a series of bluffs on the east side of the river north to the Arkansas state line. Some of these bluffs are separated from the river by point bars which tend to change position and size from one high water period to the next. North of Millers Bluff the flood plain of the Red River swings sharply to the east, forming a broad flat some 4 miles wide. A series of lakes was formed on this surface during the last century by the diversion of waters from the main channel of the river by the head of the Red River raft. These lakes were drained during the early part of this century to make the land available for agricultural purposes.

The surface of the Red River flood plain drops approximately 50 feet in elevation from the Arkansas state line to the southern boundary of Bossier Parish.

STRUCTURAL GEOLOGY

Structurally Bossier Parish is situated on the northeast flank of the Sabine uplift, one of the major structural features of the Gulf Coastal Plain. The effects of this uplift in Bossier Parish are very evident on the subsurface contour maps included in this report (plates 2 and 3). An abrupt monocline, constituting the northeast flank of the Sabine uplift, divided Bossier Parish into two relatively flat platforms, the one in northeastern Bossier Parish being 600 to 700 feet structurally below the main Sabine platform to the southwest. In Bossier Parish this monoclinal flexure trends from the area just north of the Bellevue dome in T19N, R11W northwest to T22N, R14W where the area is complicated by numerous surface faults. It is very likely that this flexure is due in part to faulting, but subsurface data are insufficient to substantiate this possibility.

The two principal structural features of Bossier Parish, the Bellevue dome of the east central part, and the Sligo dome of the south central part, are related to this flexure. The Bellevue dome is situated on the edge of the Sabine platform and is separated from the Sligo dome to the south by a prominent structural re-entrant extending from the Minden syncline to the east. This re-entrant, mapped on plate 2 as a syncline with limbs converging strongly to the west, is very likely modified by faulting. The Bellevue dome is complexly faulted around its south flank with faults trending northeast-southwest. The most apparent one on the Annona structural map (plate 2) has a displacement of some 300 feet, down to the south. Two surface faults have been mapped south of Fillmore, section 9, T18N, R11W, and have the same trend as the main Bellevue fault. Sediments along all of these faults have undergone movement downward to the south; therefore, these faults may represent a zone of faulting which has modified the syncline into a steep-sided structure. The south limb of this syncline is not as steep as the north limb but probably is also influenced by faulting. Plate 13 shows two aerial photo lineations extending parallel to this limb of the structure, but no surface faults were found in this area.

The Sligo dome is situated on the Sabine platform some 12 miles south-southwest of the Bellevue structure and has not undergone the degree of deformation experienced by the latter. No faulting is evident in the sediments above the Austin group of the Upper Cretaceous, but mapping of deeper units may show faulting to exist.

The Bellevue dome has the better surface expression of the two structures and is quite evident on the geological map (plate 1). The amount of uplift, measured on top of the Upper Cretaceous Arkadelphia formation, exceeds 1500 feet. The presence of lower Wilcox strata in and around the community of Bellevue reveals the abnormality of the area. Without the influence of this structure, the normal northeast dip from the center of the Sabine uplift would have carried the Wilcox beneath the Claiborne 6 miles to the south at Fillmore. The true magnitude of the uplift was not realized until drilling revealed the presence of the Upper Cretaceous Nacatoch formation at a depth of 300 feet on the crest of the dome. The eastern and central part of the structure is covered by a mantle of Prairie deposits, obscuring the Midway shales which normally would be exposed due to this amount of uplift.

Bore hole 58-12 was drilled approximately one mile northeast of the Bellevue community in NW$\frac{1}{4}$, SW$\frac{1}{4}$, section 33, T20N, R11W and penetrated 39 feet of undifferentiated terrace deposits before passing into 5 feet of interbedded white kaolinitic clay and black shale which, according to C. R. Smith,[1] was identical to the Midway lithology of the Pine Island area of Caddo Parish where the Midway is exposed. Below this interval, 20 feet of typical Wilcox lithology was encountered. It was not possible to drill this hole deeper to see if additional Midway-like lithology occurred below the 20 feet of lignitic, feldspathic sand. This may indicate an inter-fingering of Midway-Wilcox lithologies around the crest of the dome during late Paleocene-early Eocene. The basal "Wilcox" lithology could be Paleocene in age. The thickness of the Midway section, reduced to some 300 to 400 feet on the flanks of the dome, implies a positive nature for the structure in the Paleocene. An unknown amount of Midway sediments has been removed by Pleistocene erosion so the original depositional thickness of the group may never be known. A small amount of thinning is observed in some of the Upper Cretaceous formations around the dome.

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[1] C. R. Smith, 1958, personal communication.

The Sligo dome is not as well-defined on the surface as the Bellevue structure, but the uplift, a northwest-southeast trending dome centered in sections 26 and 27, T17N, R11W, is revealed by eastward dips on the base of the Carrizo formation in excess of the normal amount for this area, i.e., 30 to 40 feet per mile northeast. The Carrizo occurs at an elevation of 340 feet in the Sligo oil field area, capping the hill tops, and dips east at 50 to 60 feet per mile. Little can be said regarding the undifferentiated Wilcox sediments in this area because the shallow interval is not recorded on electrical logs of wells drilled in the field.

Two faults have been mapped by this writer in the Haughton-Fillmore area between the Bellevue and Sligo domes. One of these is not apparent on the geological map because it lies entirely within the outcrop of the undifferentiated lower Claiborne. The other fault, crossing state highway 157, 0.25 mile south of Fillmore, is quite apparent on the geological map. This fault has a displacement of less than 10 feet, down to the south, and has been mapped to the west across the south slope of Giddens' Hill in section 17, T18N, R11W where a series of 10 bore holes was drilled to determine the nature of the lower Claiborne sediments in this area. This series of holes, begun at the top of the hill near the trailer park and extending south to the bottom of the hill, penetrated 150 feet of glauconitic clay and pyritic sand with occasional sideritic ironstone ledges. The southernmost hole of this series bottomed in the Carrizo sand.

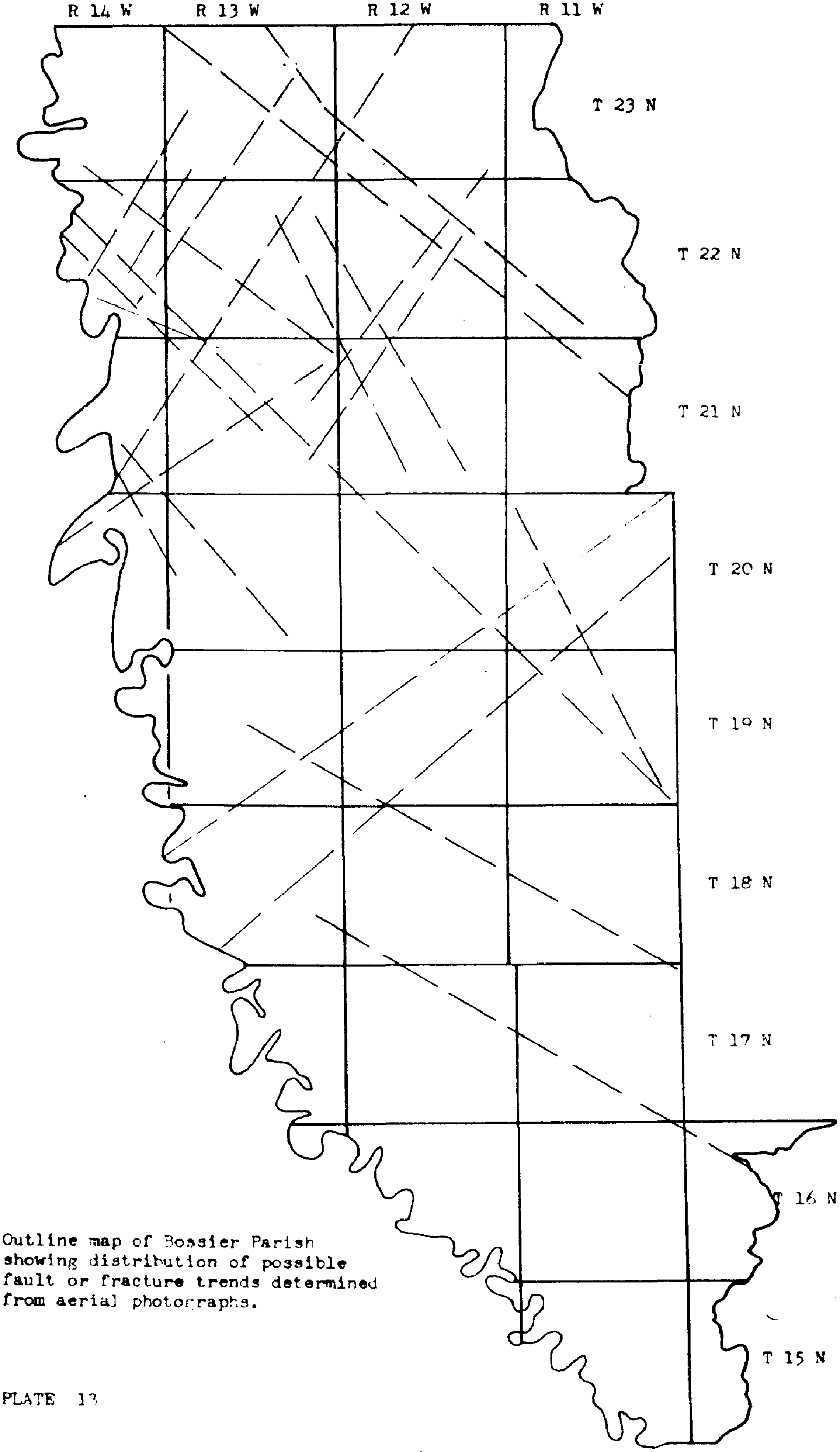
The second fault, crossing state highway 157, 0.9 mile south of Fillmore, was established by bore hole data. The presence of fossiliferous glauconite in the creek bed 100 yards east of the highway gave the first indication of faulting. Bore hole 57-18 was drilled to a depth of 48.5 feet just north of the fault trace at the west edge of the road and encountered no glauconite to correspond to that found in the creek south of the fault. The movement along this fault is calculated to be 30 to 40 feet, down to the south. The fault trace becomes indistinct to the west and apparently does not cross the Red Point-Haughton road.

The possibility exists that a fault passes just southeast of Cypress Lake in section 13, T20N, R14W. A distinct northeast-southwest lineation is seen on aerial photos of the area, and undifferentiated Wilcox shales exposed in the spillway of the lake are dipping 30 to 40 degrees to the south, indicating some abnormality. Most of the area surrounding the lake is covered with Pleistocene deposits and no fault trace was seen.

The area between Coushatta Bluff and Millers Bluff in T22N, R14W is one of rather complex faulting. No wells have been drilled in this immediate vicinity and subsurface information is lacking, but the subsurface contours drawn on the base of the Annona chalk (plate 2) southeast and north of this area show a change in strike from northwest to a more westerly direction. Since the surface faults are concentrated in this same area, it is possible that this change in strike, if it is substantiated by additional well information, is evidence of a basement flexure. This flexing could have produced the surface faults which trend generally northwest-southeast and northeast-southwest.

The most apparent result of this faulting is an uplifted, triangular block in the Gilmer Hill area in sections 22, 23, 25 and 36, T22N, R14W. This block is bounded by normal faults with displacements ranging from 10 feet to approximately 40 feet. The displacements were determined largely by shallow bore holes drilled throughout the area. The presence of two Queen City sand members, the Arp and the Myrtis, complicated the establishment of displacements on these faults. These two sands have about the same thickness and are overlain and underlain by similar lithologies; consequently, they were difficult to identify and the actual displacements along the faults were not determined readily. The fault limiting the north side of the high block has an estimated displacement of 40 feet, down to the north. The fault passing through the E $\frac{1}{2}$ of section 28 of this township, separating undifferentiated lower Claiborne from the Reklaw, Queen City and Weches, serves as a convenient dividing line between the unit designations. Bore hole 57-44, drilled 0.6 mile east of the south end of this fault in section 12, T21N, R14W, penetrated 48 feet of glauconitic clay with no sand section encountered. This fault occurs in the approximate area where the southward thinning of the Queen City sand members renders unfeasible the farther southward differentiation of the lower Claiborne interval.

Plate 13 is an outline map of Bossier Parish with plotted lineations observed on aerial photo mosaics. These traces may be faults or only fractures but, in any case, they represent some abnormality in the soil zone. Fractures may restrict the movement of ground water to cause a change in foliage tone or soil color on the photos. These



Outline map of Bossier Parish showing distribution of possible fault or fracture trends determined from aerial photographs.

PLATE 13

are clues to be considered in the interpretation of the geology of any area and this study proved useful in the location of some faults in Bossier Parish. Several faults mapped on the surface are not indicated on the photos so the validity of these plotted traces is not established. This plate is included herein with the hope that it may arouse interest concerning certain areas of Bossier Parish.

One particularly interesting set of lineations extends from T20N, R11W southwest to T18N, R13W, generally parallel to the alluvial valley of Bayou Bodcau in T19 and 20N, R11W. These lineations may represent the surface traces of faults bounding a graben. This area is just north of the crest of the Bellevue dome and such fault structures are not unlikely. There is no subsurface information to substantiate this possibility.

ECONOMIC GEOLOGY

The economic geology of Bossier Parish is centered primarily around the production of oil and gas from 18 separate fields. There is little else of economic geological importance in the parish. Chert or quartzite gravel, common in Pleistocene deposits in other parts of the state, occurs in such limited quantities in Bossier Parish that no economic importance is attached to it. This gravel occurs in the higher Pleistocene deposits which are limited in areal extent and are only moderately graveliferous. Ironstone gravel is used locally for road construction but is variable in thickness and no one borrow pit yields any appreciable tonnage.

Bossier, Caddo and Webster Parishes were the subject of iron-ore investigations by Burchard[1] in 1915. Several localities in Bossier Parish were reported to have rich iron-bearing ledges but nothing of an economic nature. Samples collected by Burchard from sideritic ironstone ledges at Millers Bluff in section 10, T22N, R14W ran better than 38 percent metallic iron. Samples from the Cook Mountain ironstones at Rocky Mount and northwest of Plain Dealing ran 36 percent and 52 percent metallic iron, respectively. Burchard did not attach any economic value to any of these deposits. The ironstones of the undifferentiated lower Claiborne occur as ledges with an average thickness of less than 1 foot, and are overlain by such a thickness of

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[1]Burchard, *op. cit.*, pp. 134-143.

overburden that their utilization would not be feasible.

The Cook Mountain formation contains a large amount of glauconite but this has been found to be sporadically distributed and varying in concentration. Rather thick deposits of glauconite are found northwest of Redland in section 19, T23N, R12W and at Rocky Mount in sections 17 and 18, T21N, R12W. These glauconites are indurated only locally to ironstone and are a possible source of iron ore if suitable shipping facilities were made available. Only one railroad, the St. Louis Southwestern, serves this part of the parish and is 7 miles away from the Rocky Mount deposit. This writer does not consider iron to be an economically feasible enterprise in Bossier Parish due to sporadic distribution of deposits, varying concentration of metallic iron, and the inaccessibility of the deposits to existing railroads.

No suitable pottery clays were found by the writer in Bossier Parish. Pottery clays are found in Caddo Parish to the west where the Midway Porters Creek formation is exposed. Removal of at least 50 feet of Pleistocene deposits on the crest of the Bellevue dome would expose Porters Creek clays but the feasibility of such an operation is questionable.

Extensive deposits of Sparta sand in Bossier Parish might be utilized for industrial purposes. The basal massive sands of the formation are relatively clean and well-sorted in some areas, particularly the area east of the Benton cycling plant in sections 6, 7 and 8, T20N, R12W. In most other areas of the parish the basal Sparta sand was found to contain lignite which would tend to limit its industrial value.

BIBLIOGRAPHY

Alexander, C. I. "Stratigraphy of Midway Group (Eocene) of southwest Arkansas and northwest Louisiana", Bull. Am. Assoc. Pet. Geol., XIV (1935), 696-702.

_________. "Common and Significant Species of Foraminifera and Ostracoda of the Brownstown, Ozan and Annona Formations of southwest Arkansas", Guide Book, 14th An. Field Trip, Shreveport Geol. Soc., (1939), pp. 64-67.

Barry, J. O., and LeBlanc, R. J. "Correlation of Wilcox Faunal Units of Louisiana", (Abstract), Bull. Am. Assoc. Pet. Geol., XXV (1941), 941.

Belchic, G., and Breitung, C. A. "Gas Production from the Springhill-Sarepta Gas Field, Webster and Bossier Parishes, Louisiana", Bull. Am. Assoc. Pet. Geol., VII (1941), 555-557.

Berry, E. W. Lower Eocene Floras of Southeastern North America, U. S. Geol. Surv. Prof. Paper 91 (1916), 481 pp.

_________. Revision of the Lower Eocene Flora of the Southeastern States, U. S. Geol. Surv. Prof. Paper 156 (1930), 189 pp.

Burchard, E. F. Iron-Bearing Deposits of Bossier, Caddo and Webster Parishes, Louisiana, U. S. Geol. Surv. Bull. 620 (1915), pp. 129-50.

Burst, J. F. "'Glauconite' Pellets: Their Mineral Nature and Applications to Stratigraphic Interpretations", Bull. Am. Assoc. Pet. Geol., XXXXII (1958), 310-325.

Calahan, L. W. "Diagnostic Fossils of the Ark-La-Tex Area", Guide Book, 14th An. Field Trip, Shreveport Geol. Soc., (1939), pp. 36-55.

Crider, A. F. "Geology of the Bellevue Oil Field", Bull. Am. Assoc. Pet. Geol., XXII (1938), 1658-1681.

_________. "Relation of Upper Cretaceous to Eocene Structures in Louisiana and Arkansas", Bull. Am. Assoc. Pet. Geol., VII (1923), 378-383.

Dane, C. H. Upper Cretaceous Formations of Southwestern Arkansas, Ark. Geol. Surv. Bull. 1 (1929), 215 pp.

Darton, N. H., and Others. Geological Map of Texas, 1:500,000, U. S. Geol. Surv., (1937).

Ellisor, A. C. "Correlation of the Claiborne of east Texas with the Claiborne of Louisiana", Bull. Am. Assoc. Pet. Geol., XIII (1929), 1334-1346.

Harris, G. D. The Tertiary Geology of southwest Arkansas, An. Rept. Ark. Geol. Surv., II (1892), Pt. 1.

_________. (with Veatch and Pacheco). "A Report of the Geology of Louisiana", La. Expt. Sta. (1902), Pt. 6.

_________. Pelecypoda of the St. Maurice and Claiborne Stages, Am. Paleo. Bull. VI (1919), 268 pp.

Hazzard, R. T., and Lloyd, A. M. "Northeast-southwest Cross-section from Dallas County, Arkansas", Guide Book, 14th An. Field Trip, Shreveport Geol. Soc., (1939), p. 92.

Holeman, E., and Campbell, R. B. "The Bellevue Oil Field", Bull. Am. Assoc. Pet. Geol., VII (1923), 645-652.

Hollick, A. "A Report on a Collection of Fossil Plants from Northwestern Louisiana", La. Expt. Sta., Part 5, Sp. Rept. 5 (1899), pp. 278-289.

Howe, H. V. "Review of Tertiary Stratigraphy of Louisiana", Bull. Am. Assoc. Pet. Geol., XVII (1933), 613-655.

_________. Louisiana Cook Mountain Eocene Foraminifera, La. Geol. Surv. Bull. 14 (1939), 122 pp.

Huntley, L. G. "The Sabine Uplift", Bull. Am. Assoc. Pet. Geol., VII (1923), 179-181.

Hull, J. P. D., and Spooner, W. C. "Oil and Gas Pools of north Louisiana", Bull. Am. Assoc. Pet. Geol., VI (1922), 179-192.

Hull, J. P. D. "The Bellevue Oil Pool, Louisiana", Bull. Am. Assoc. Pet. Geol., V (1921), 247-250.

Hussey, K. M. "Louisiana Cane River Eocene Foraminifera", Jour. Paleo., XXIII (1949), 109-144.

Israelsky, M. C. "Tentative Foraminiferal Zonation of Subsurface Claiborne of Texas and Louisiana", Gulf Coast Oil Fields, Am. Assoc. Pet. Geol., (1936), pp. 425-431.

Johnson, L. C. The Iron Ore Regions of north Louisiana and east Texas, 50th. Cong., 1st Sess., House Doc. 195 (1888), 54 pp.

Knebel, M. G. (See Wendlandt, E. A.)

LeBlanc, R. J., and Barry, J. O. "Fossiliferous Localities of Midway Group in Louisiana", Bull. Am. Assoc. Pet. Geol., XXV (1941), 734-759.

Lerch, O. "A Preliminary Report on the Hills of north Louisiana, north of the V. S. and P. Railroad", Bull. State Expt. Sta., Louisiana, (1892), Pt. 1, pp. 1-52.

Martin, J. L., and Others, Geology of Webster Parish, Louisiana, La. Geol. Surv. Bull. 29 (1954), 252 pp.

Moody, C. L. "Tertiary History of the Sabine Uplift", Bull. Am. Assoc. Pet. Geol., XV (1931), 531-551.

Murray, G. E. "Midway Stratigraphy of the Sabine Uplift", (Abstract) Bull. Am. Assoc. Pet. Geol., XXV (1941), 941-942.

__________., and Thomas, E. P. "Midway-Wilcox Surface Stratigraphy of Sabine Uplift, Louisiana and Texas", Bull. Am. Assoc. Pet. Geol., XXIX (1945), 45-70.

Powers, S. "The Sabine Uplift, Louisiana", Bull. Am. Assoc. Pet. Geol., IV (1920), 117-136.

Raymond, J. P. Hosston-Plain Dealing highway profile, unpublished cross-section, Department of Geology, La. State Univ., 1956.

Shearer, H. K. "Geology of Catahoula Parish, Louisiana", Bull. Am. Assoc. Pet. Geol., XIV (1930), 433-450.

Shreveport Geological Society. Reference Report on Certain Oil and Gas Fields of North Louisiana, South Arkansas, Mississippi and Alabama, vol. 2 (1945), 186 pp.

Smith, C. R. "Queen City-Sparta Relationships in Caddo Parish, La.", Bull. Am. Assoc. Pet. Geol., XXXXII (1958), 2517-2522.

Spooner, W. C. "Geology of the Gulf Coastal Plain of Arkansas and Louisiana", (Abstract), Geol. Soc. An. Bull. XXXIX (1928), 274-75.

__________. "Interior Salt Domes of Louisiana", Bull. Am. Assoc. Pet. Geol., X (1926), 217-292.

Statistics of Oil and Gas Development and Production, La. Geol. Surv., (1956), 63 pp.

Stenzel, H. B. "Boundary Problems", Guide Book, 9th. Field Trip, Miss. Geol. Soc., (1952), pp. 11-43.

Stenzel, H. B. The Geology of the Henrys Chapel Quadrangle, Northeastern Cherokee County, Texas, Univ. of Texas Bull. 5305 (1953), 119 pp.

________. "The Subsurface Relationships of the Carrizo Sand in Texas", Tulsa Geol. Soc. Digest, IX (1941), 70-72.

Teas, L. P. "Bellevue Oil Field, Bossier Parish, Louisiana", Structure of Typical American Oil Fields, II (1924), Am. Assoc. Pet. Geol., 229-252.

________. "Differential Compacting the Cause of Certain Claiborne Dips", Bull. Am. Assoc. Pet. Geol., VII (1923), 370-378.

Thomas, G. D. "Cartersville, Sarepta and Shongaloo Fields, Bossier and Webster Parishes, Louisiana", Bull. Am. Assoc. Pet. Geol., XXII (1938), 1473-1503.

________., and Rice, E. M. "Notes on the Saratoga Chalk", Jour. Paleo., V (1931), 316-328.

________. "Notes on the Annona Chalk", Jour. Paleo., VI (1932), 319-329.

Vaughan, T. W. "The Stratigraphy of northwestern Louisiana", The Am. Geol., XV (1895), 205-229.

________. A Brief Contribution to the Geology and Paleontology of northwestern Louisiana. U. S. Geol. Surv. Bull. 142 (1896), 65 pp.

Veatch, A. C. "The Shreveport Area", La. State Expt. Sta., Geol. Agr. La., Pt. 5, Sp. Rept. 2 (1899), pp. 152-208.

________. Geology and Underground Water Resources of northern Louisiana and southern Arkansas, U. S. Geol. Surv. Prof. Paper 46 (1906), 422 pp.

Wallace, W. E. Geological Map of Louisiana, 1:500,000, Shreveport Geol. Soc., 1946.

Wendlandt, E. A., and Knebel, M. G. "Lower Claiborne of east Texas with Special Reference to Mt. Sylvan Dome and Salt Movements", Bull. Am. Assoc. Pet. Geol., XIII (1929), 1347-1375.

Wilmarth, M. G. Tentative Correlation of the Named Geological Units of Louisiana, chart of the U. S. Geol. Surv., 1931.

Whittemore, J. W. The Clays of Louisiana (Shreveport Area), La. Dept. Conserv. Bull. 14 (1927), 84 pp.

Woodward, T. P., and Gueno, A. J. The Sand and Gravel Deposits of Louisiana, La. Geol. Surv. Bull. 19 (1941), 366 pp.

EXAMINATION AND THESIS REPORT

Candidate: Douglas E. Jones

Major Field: Geology

Title of Thesis: Geology of Bossier Parish, Louisiana

Approved:

C. O. Durham
Major Professor and Chairman

Richard J. Russell
Dean of the Graduate School

EXAMINING COMMITTEE:

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H. V. Andersen

Grover E. Murray

Date of Examination:

May 14 1959

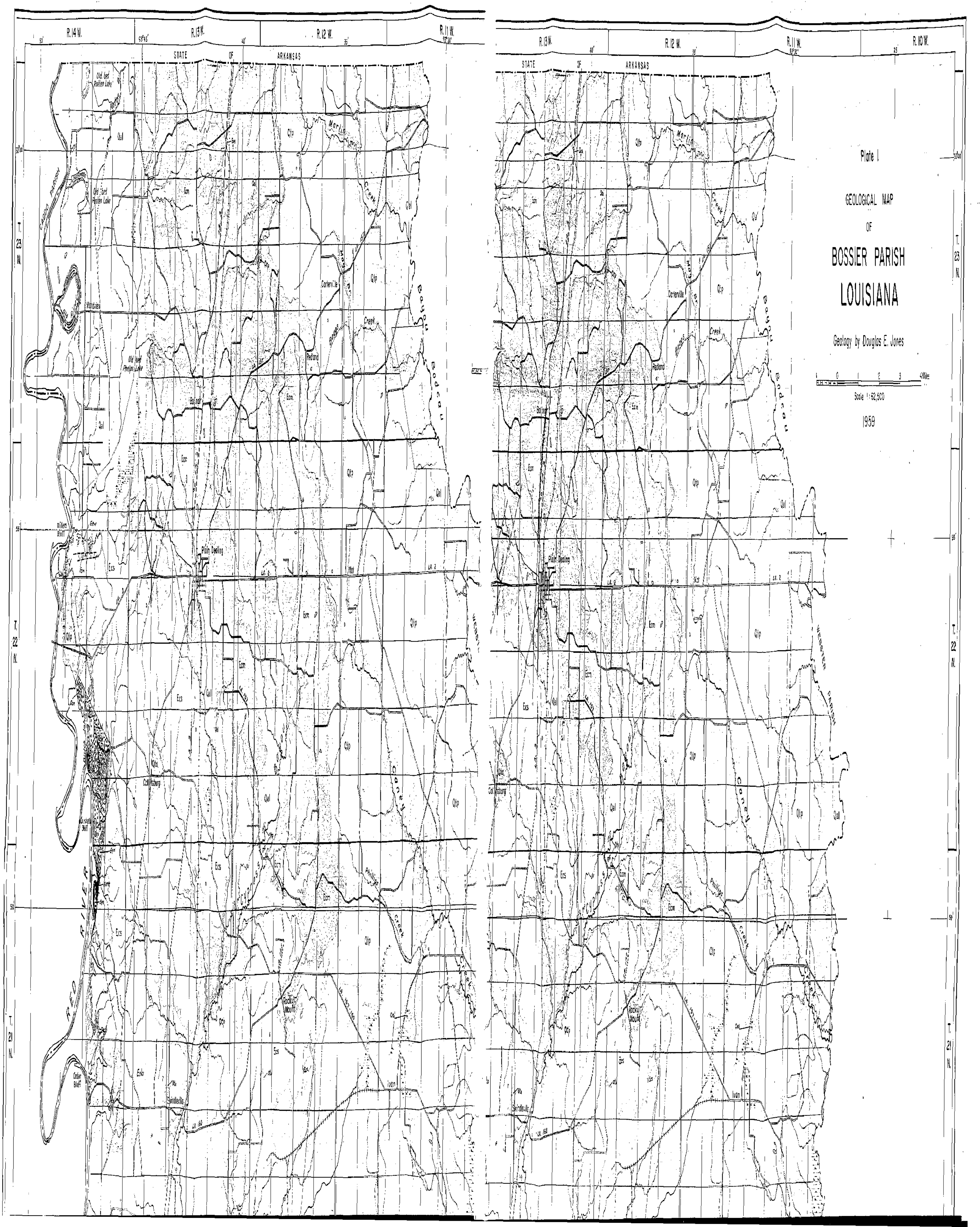
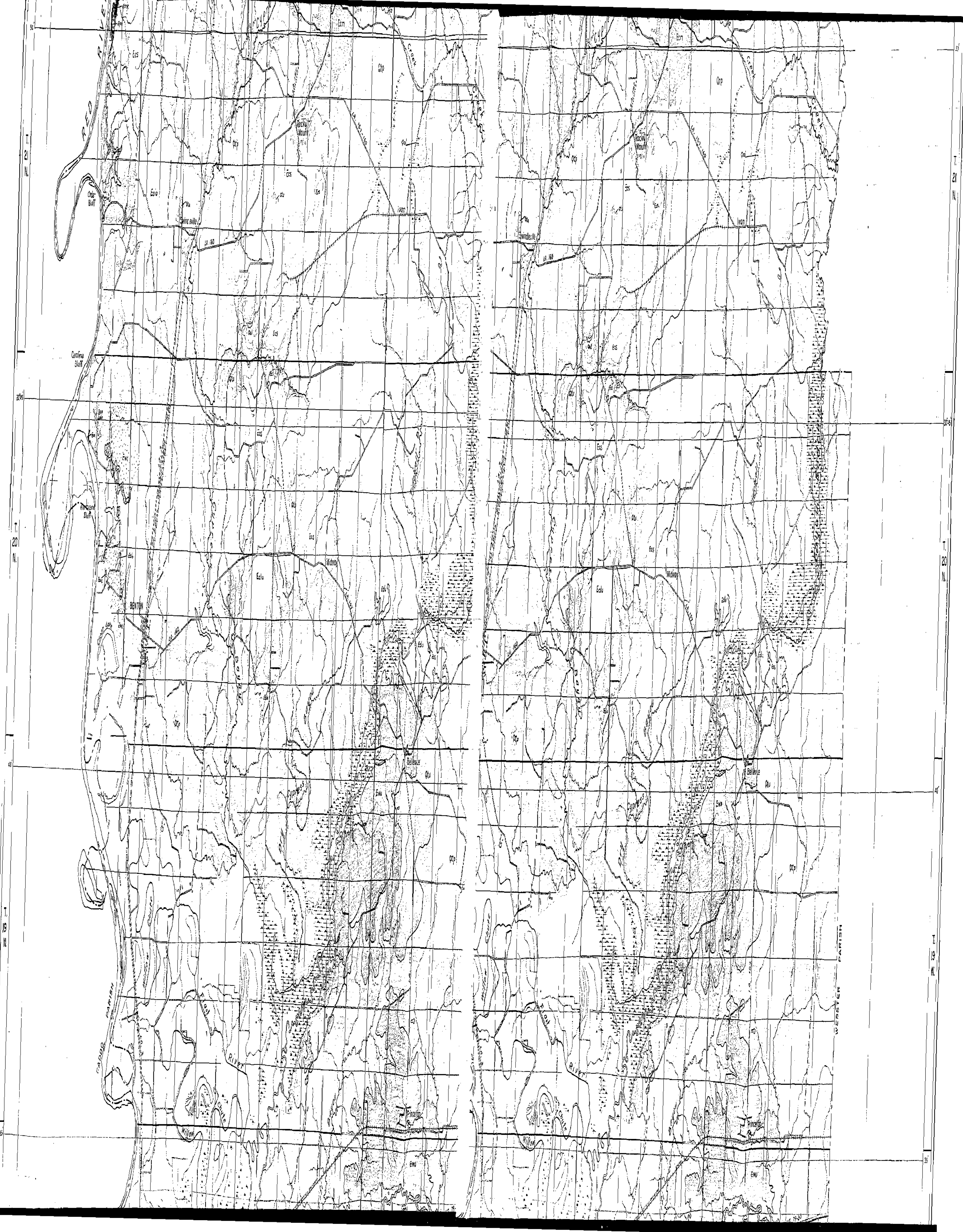
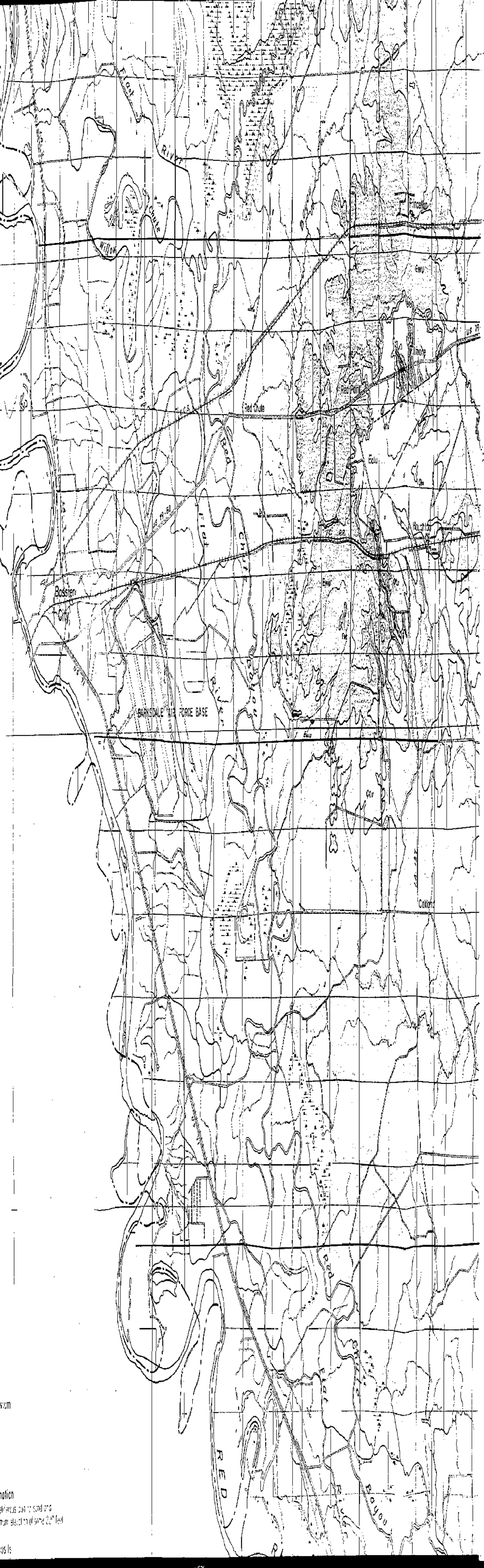
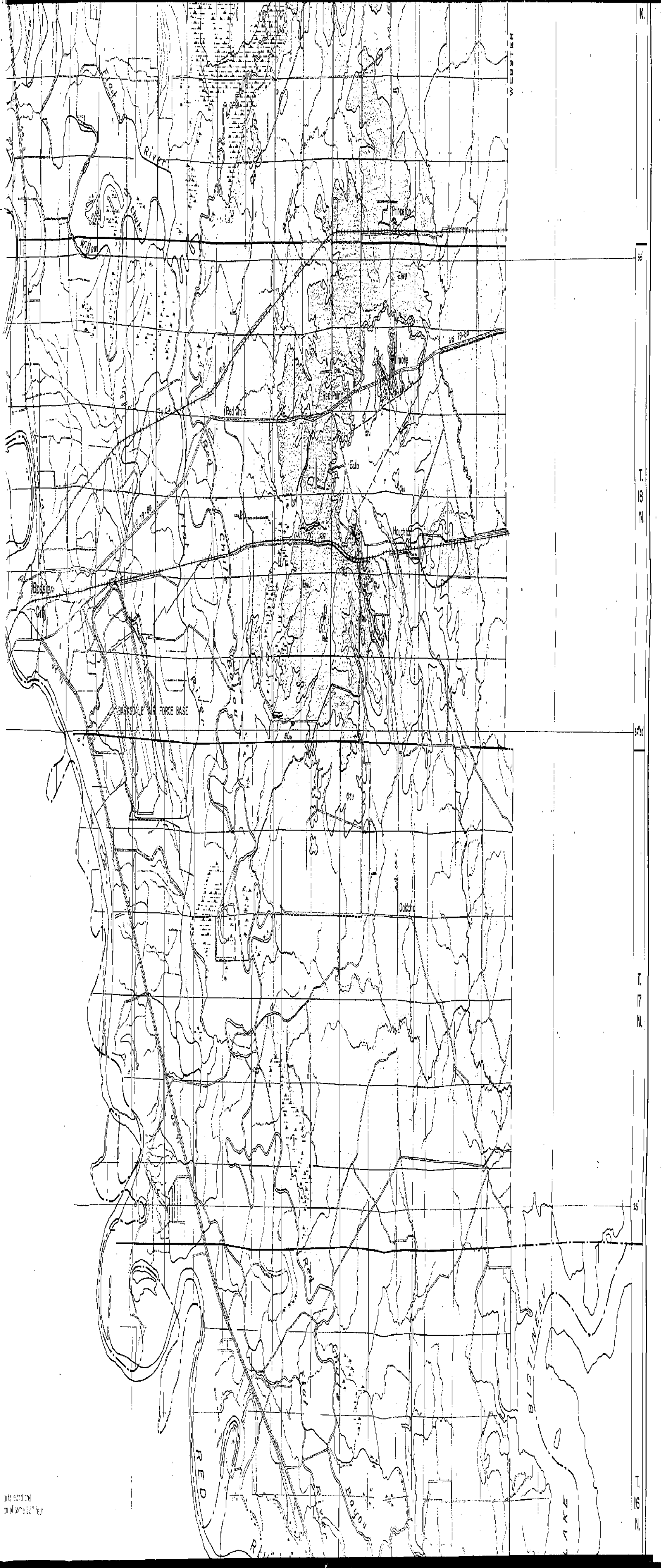


Plate I
GEOLOGICAL MAP
OF
BOSSIER PARISH
LOUISIANA
Geology by Douglas E. Jones
Scale 1:62,500
1959
STATE OF ARKANSAS
R.14 W.
R.13 W.
R.12 W.
R.11 W.
R.10 W.
T. 23 N.
T. 22 N.
T. 21 N.
Plain Dealing
Benton
Bodcau
Red River
Rocky Mount
Ivan
Plain Dealing
Redland
Carterville
Bolinger
Collinsburg
Cedar Bluff
Swindleville
Qal
Qtp
Ecm
Ecs


RED RIVER
CADDO PARISH
WEBSTER PARISH
T. 21 N.
T. 20 N.
T. 19 N.
BENTON
Bellevue
Midway
Rocky Mount
Swindle Ville
Carolina Bluff
Princeton
Cypress
Willow





EXPLANATION

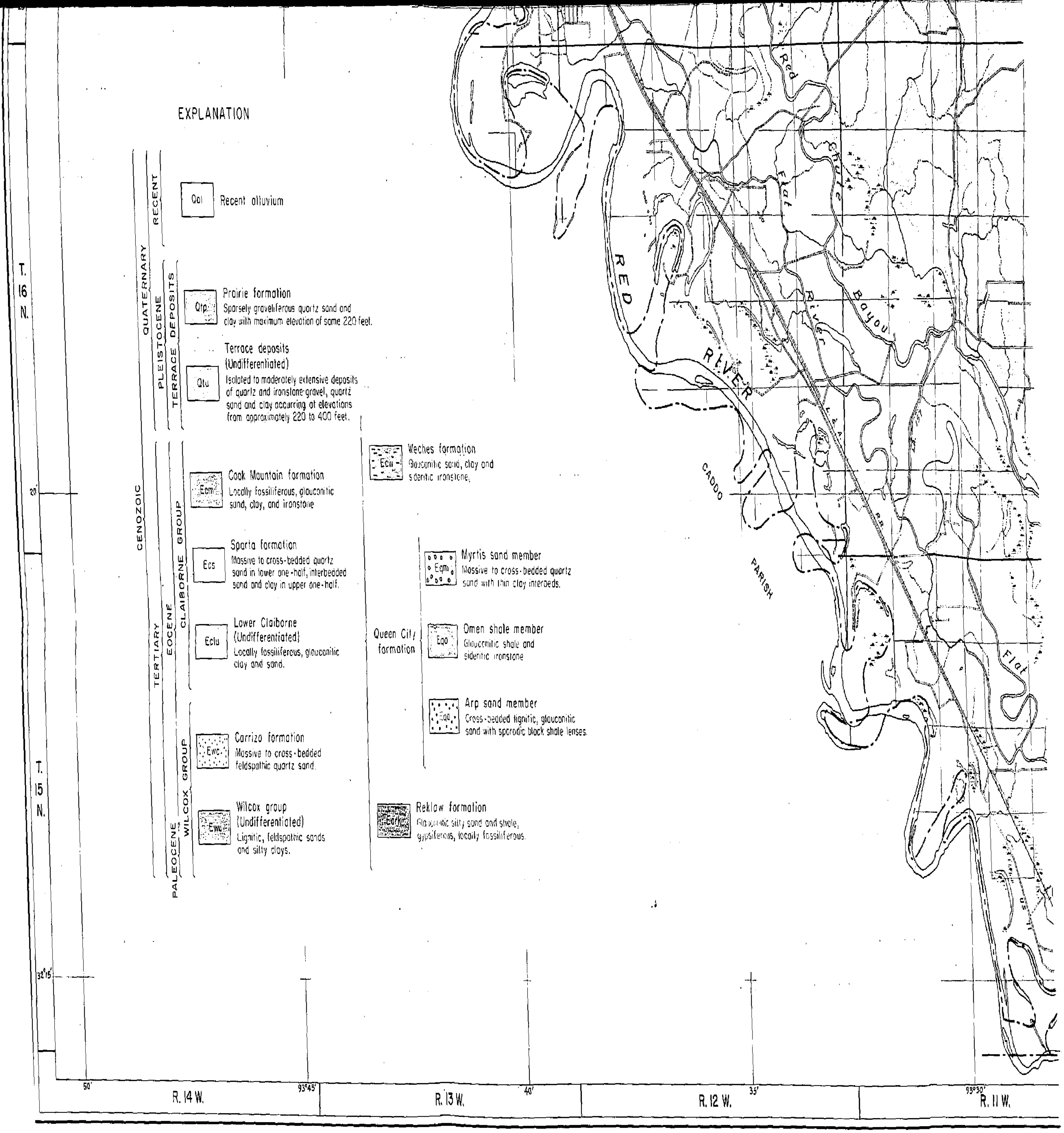
RECENT

Qal Recent alluvium

PLEISTOCENE DEPOSITS

Qtp Prairie formation

Terrace deposits



EXPLANATION
QUATERNARY
RECENT
Qal
Recent alluvium
PLEISTOCENE
TERRACE DEPOSITS
Qtp
Prairie formation
Sparsely gravelliferous quartz sand and clay with maximum elevation of some 220 feet.
Terrace deposits (Undifferentiated)
Qtu
Isolated to moderately extensive deposits of quartz and ironstone gravel, quartz sand and clay occurring at elevations from approximately 220 to 400 feet.
CENOZOIC
TERTIARY
EOCENE
CLAIBORNE GROUP
Ecw
Weches formation
Glauconitic sand, clay and sideritic ironstone.
Ecm
Cook Mountain formation
Locally fossiliferous, glauconitic sand, clay, and ironstone
Ecs
Sparta formation
Massive to cross-bedded quartz sand in lower one-half, interbedded sand and clay in upper one-half.
Queen City formation
Eqm
Myrtis sand member
Massive to cross-bedded quartz sand with thin clay interbeds.
Eqo
Omen shale member
Glauconitic shale and sideritic ironstone
Eqa
Arp sand member
Cross-bedded lignitic, glauconitic sand with sporadic black shale lenses.
Eclu
Lower Claiborne (Undifferentiated)
Locally fossiliferous, glauconitic clay and sand.
PALEOCENE
WILCOX GROUP
Ewc
Carrizo formation
Massive to cross-bedded feldspathic quartz sand.
Ewr
Reklaw formation
Glauconitic silty sand and shale, gypsiferous, locally fossiliferous.
Ewu
Wilcox group (Undifferentiated)
Lignitic, feldspathic sands and silty clays.
T. 16 N.
T. 15 N.
20'
32°15'
RED RIVER
Red River
Flat
Chute
Bayou
Flat
CADDO PARISH
50'
93°45'
40'
35'
93°30'
R. 14 W.
R. 13 W.
R. 12 W.
R. 11 W.

sand and
some 220 feet.

...e deposits
l, quartz
evations
00 feet.

Weches formation — Glauconitic sand, clay and sideritic ironstone. (Eqw)

tic

tz
bedded
half.

Queen City formation

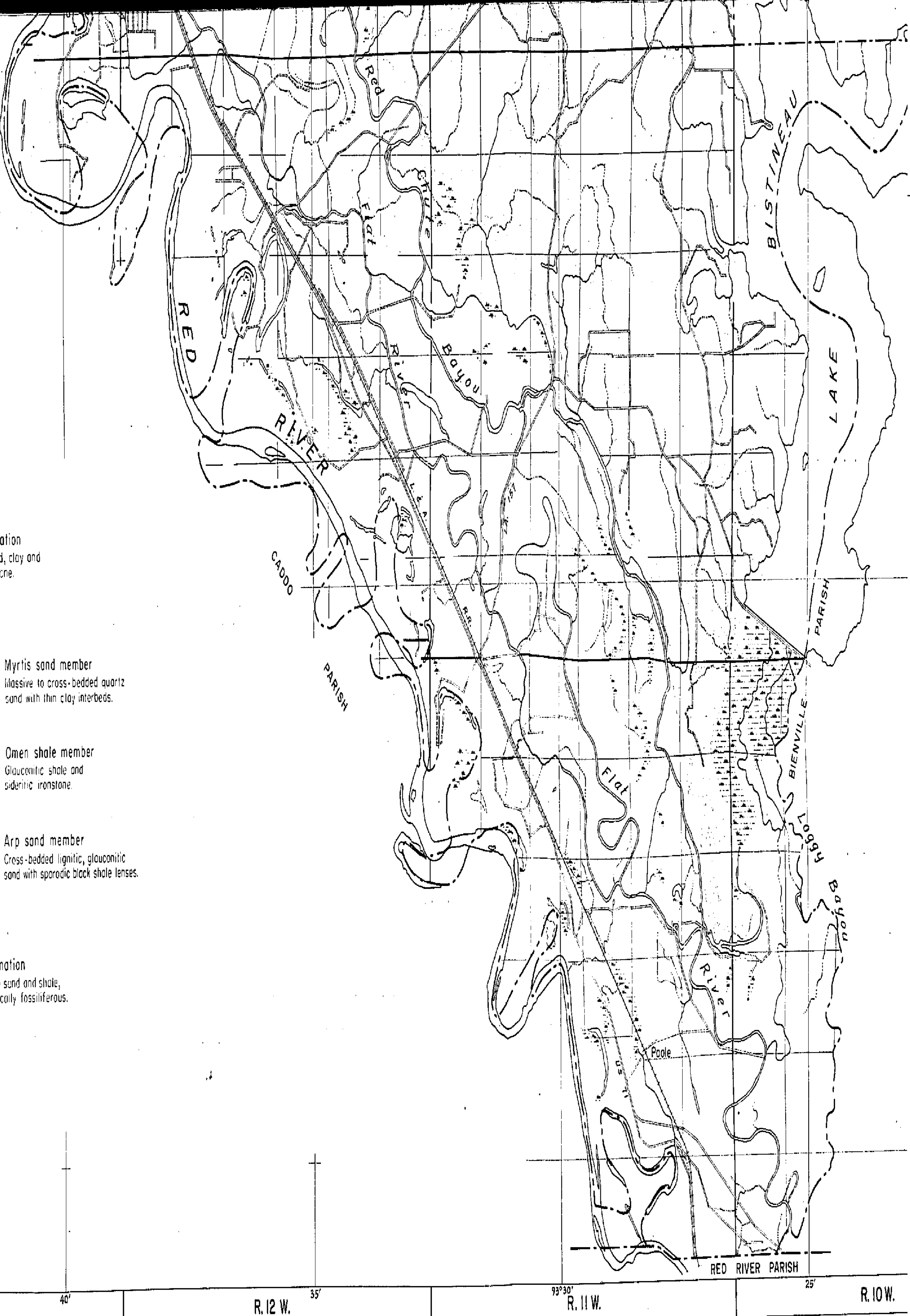
Myrtis sand member — Massive to cross-bedded quartz sand with thin clay interbeds. (Eqm)

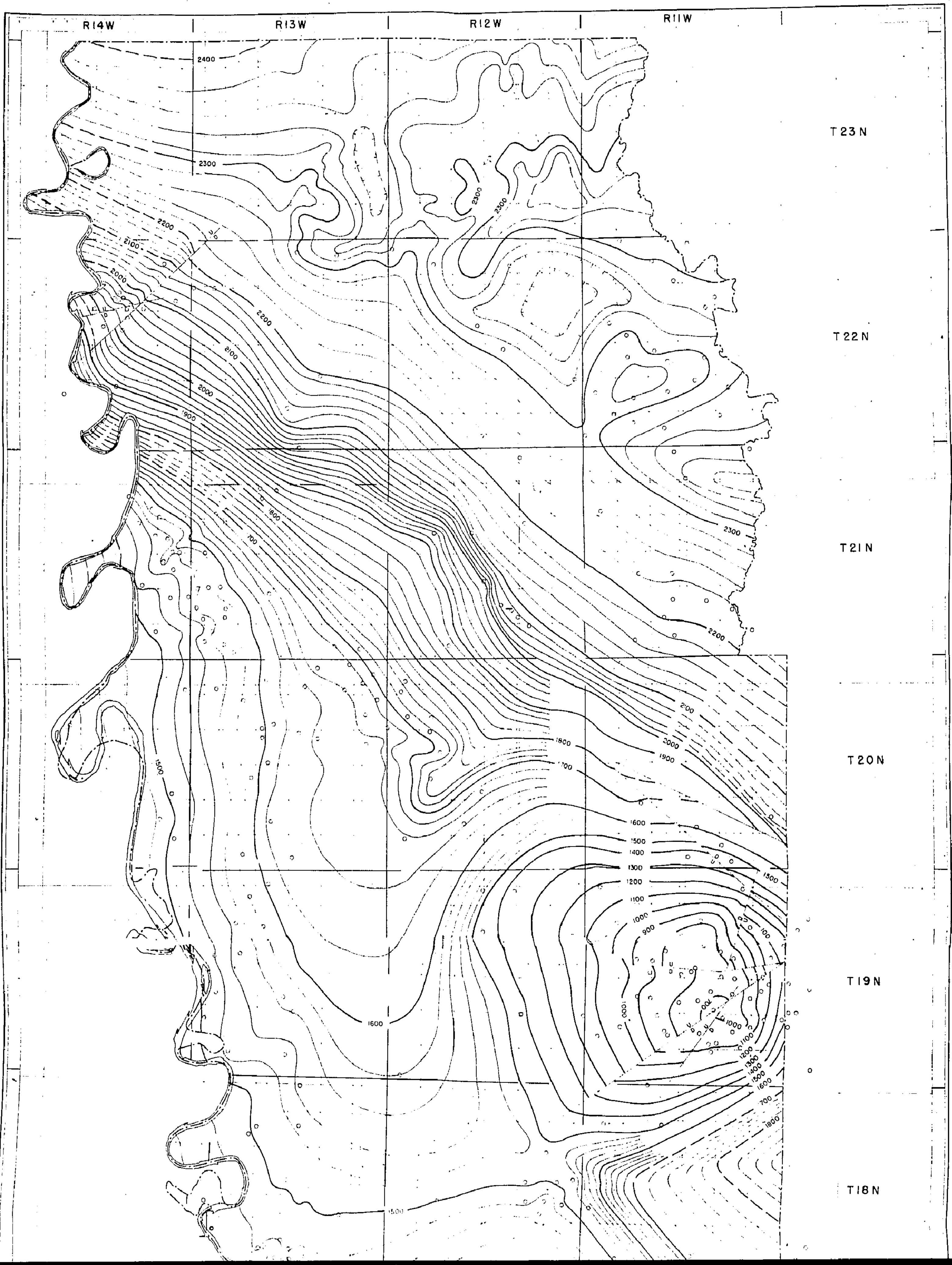
Omen shale member — Glauconitic shale and sideritic ironstone. (Eqo)

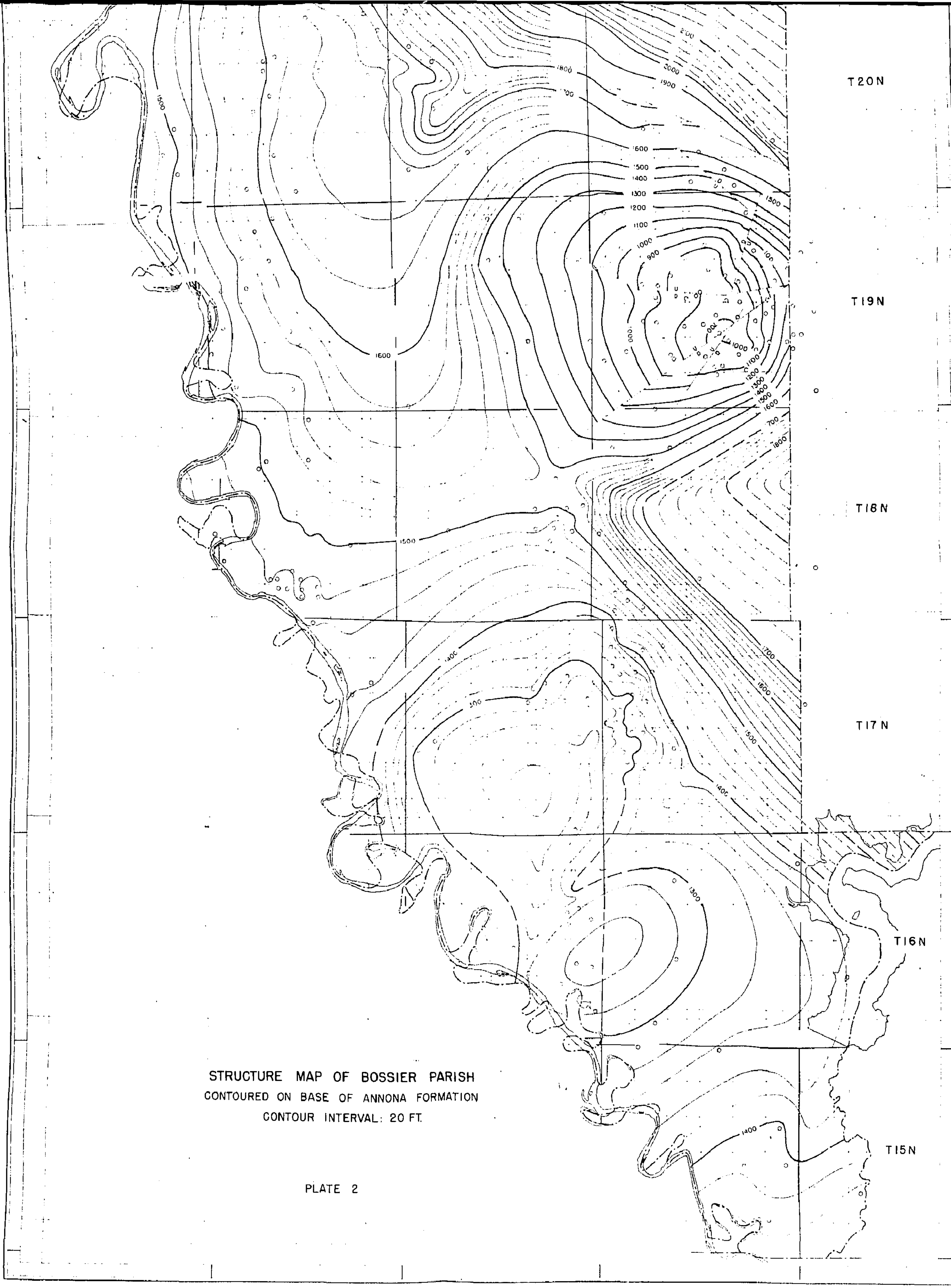
Arp sand member — Cross-bedded lignitic, glauconitic sand with sporadic black shale lenses. (Eqa)

itic

Reklaw formation — Glauconitic silty sand and shale, gypsiferous, locally fossiliferous. (Er)

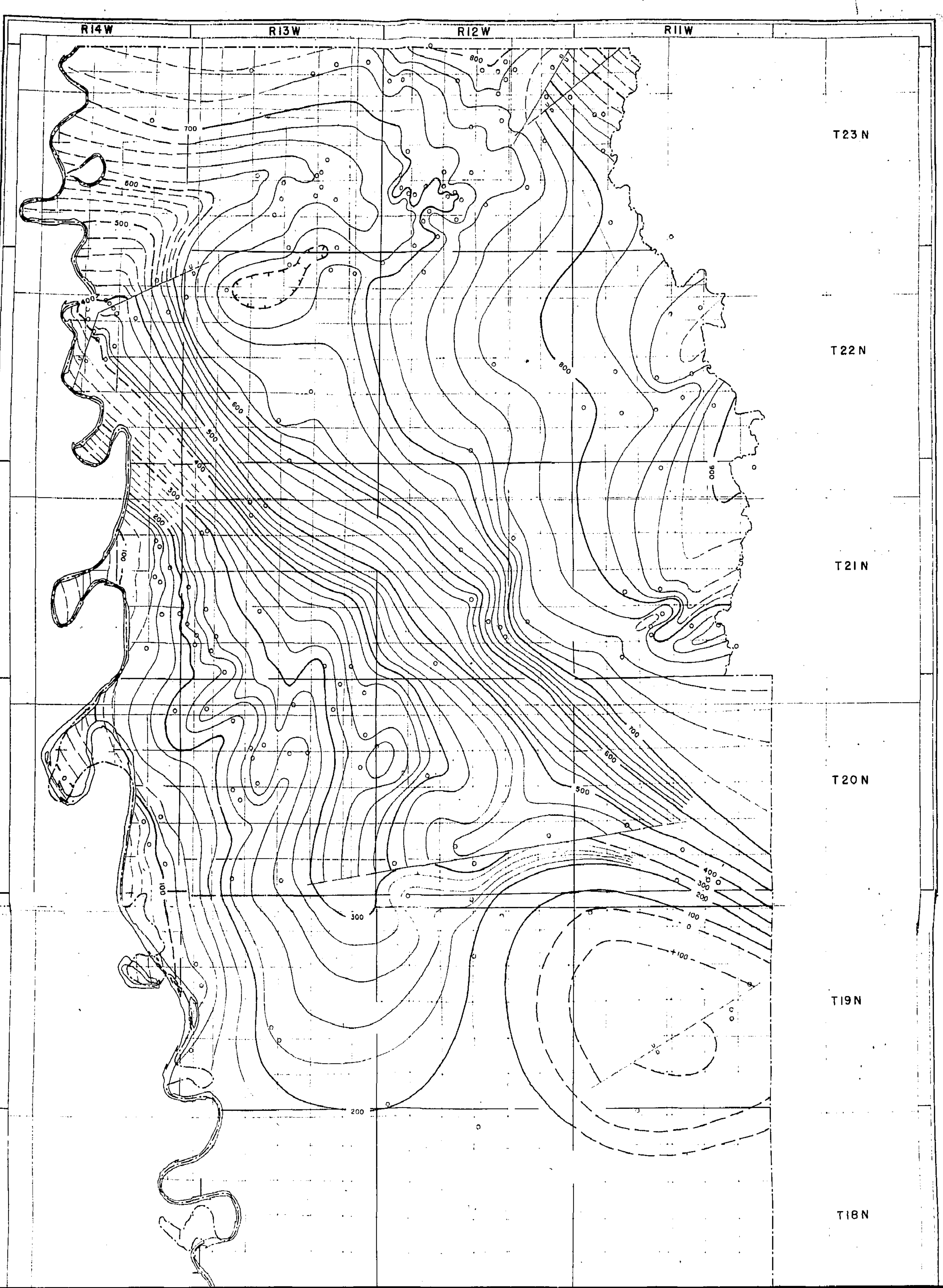



R14W
R13W
R12W
R11W
T23N
T22N
T21N
T20N
T19N
T18N
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900

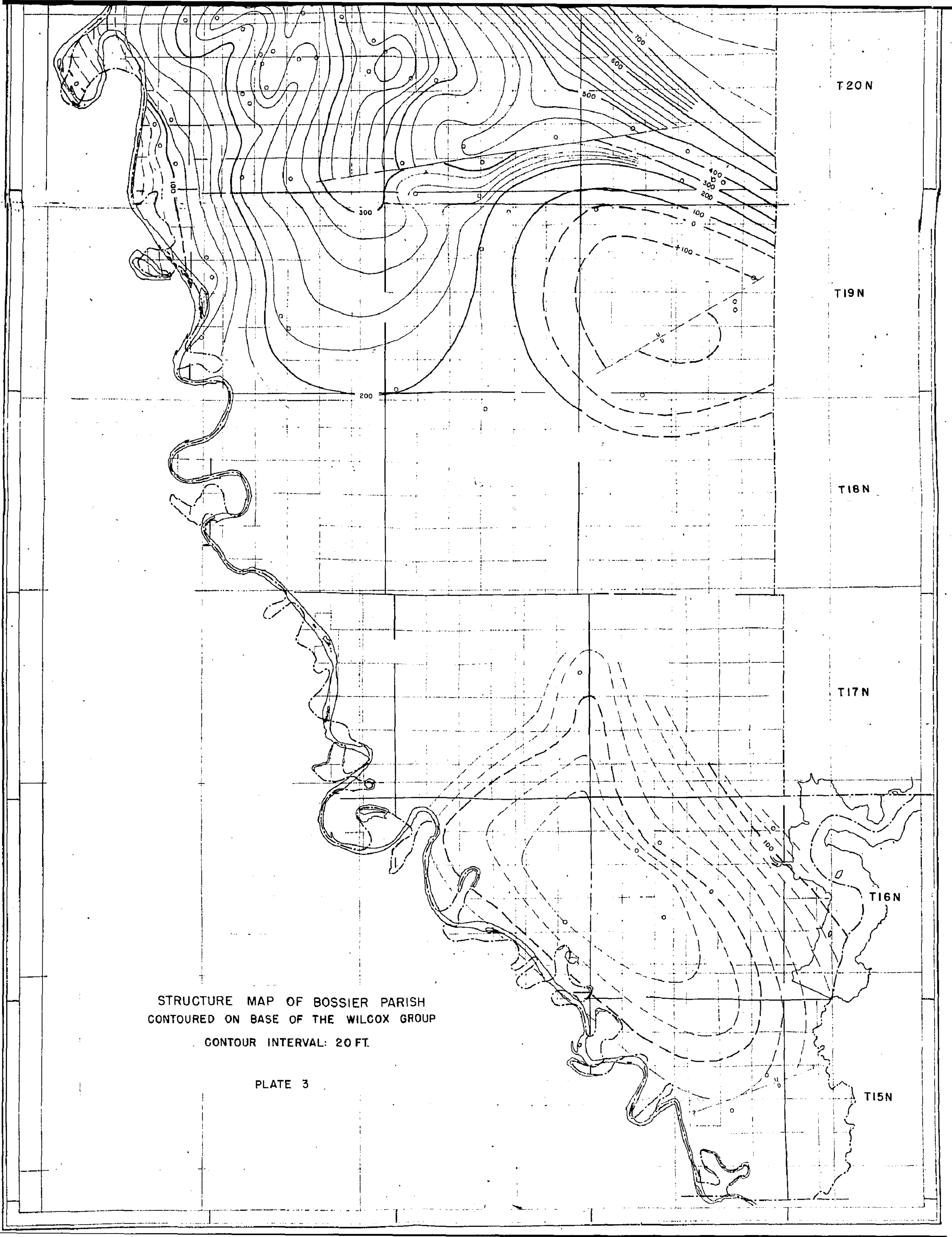


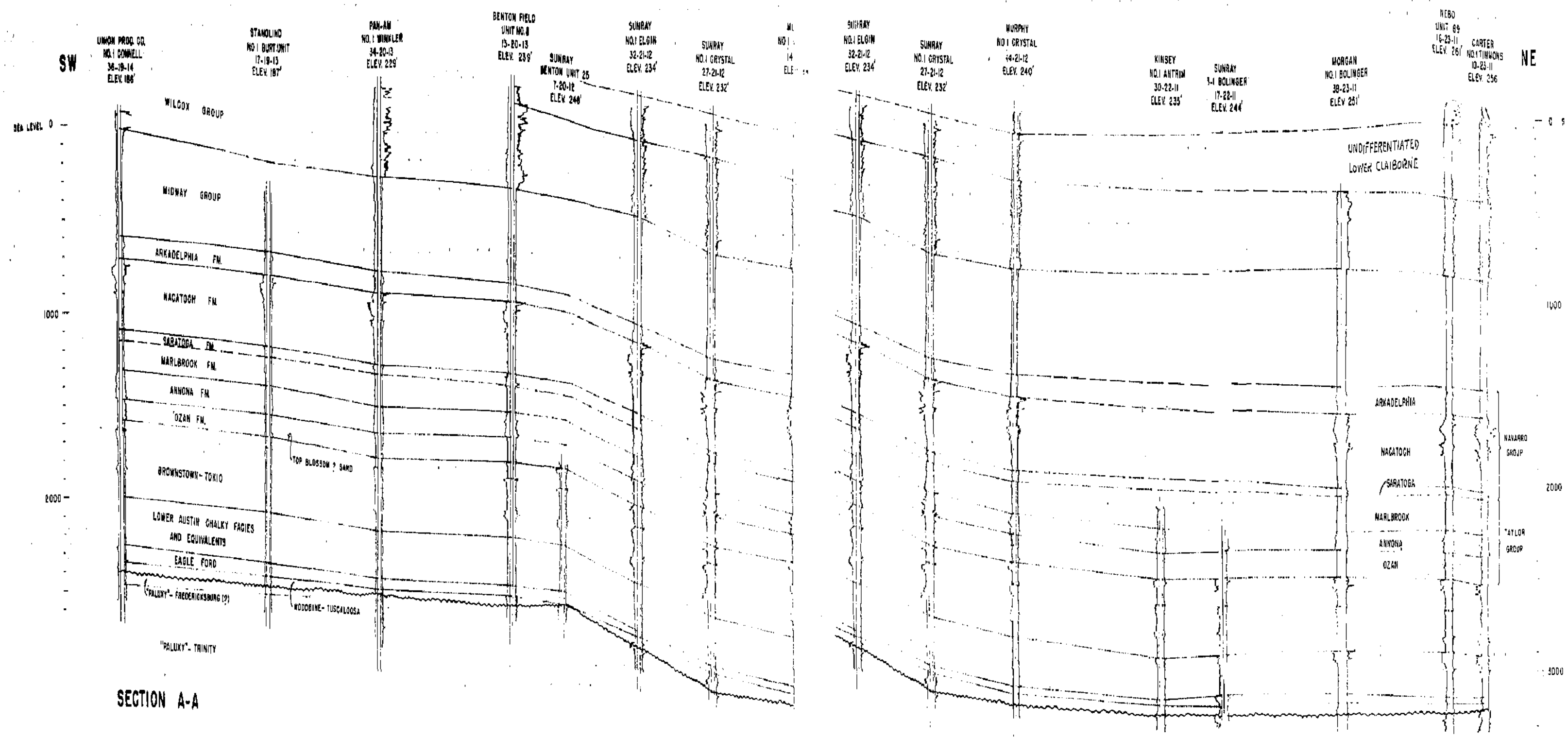
STRUCTURE MAP OF BOSSIER PARISH
CONTOURED ON BASE OF ANNONA FORMATION
CONTOUR INTERVAL: 20 FT.

PLATE 2

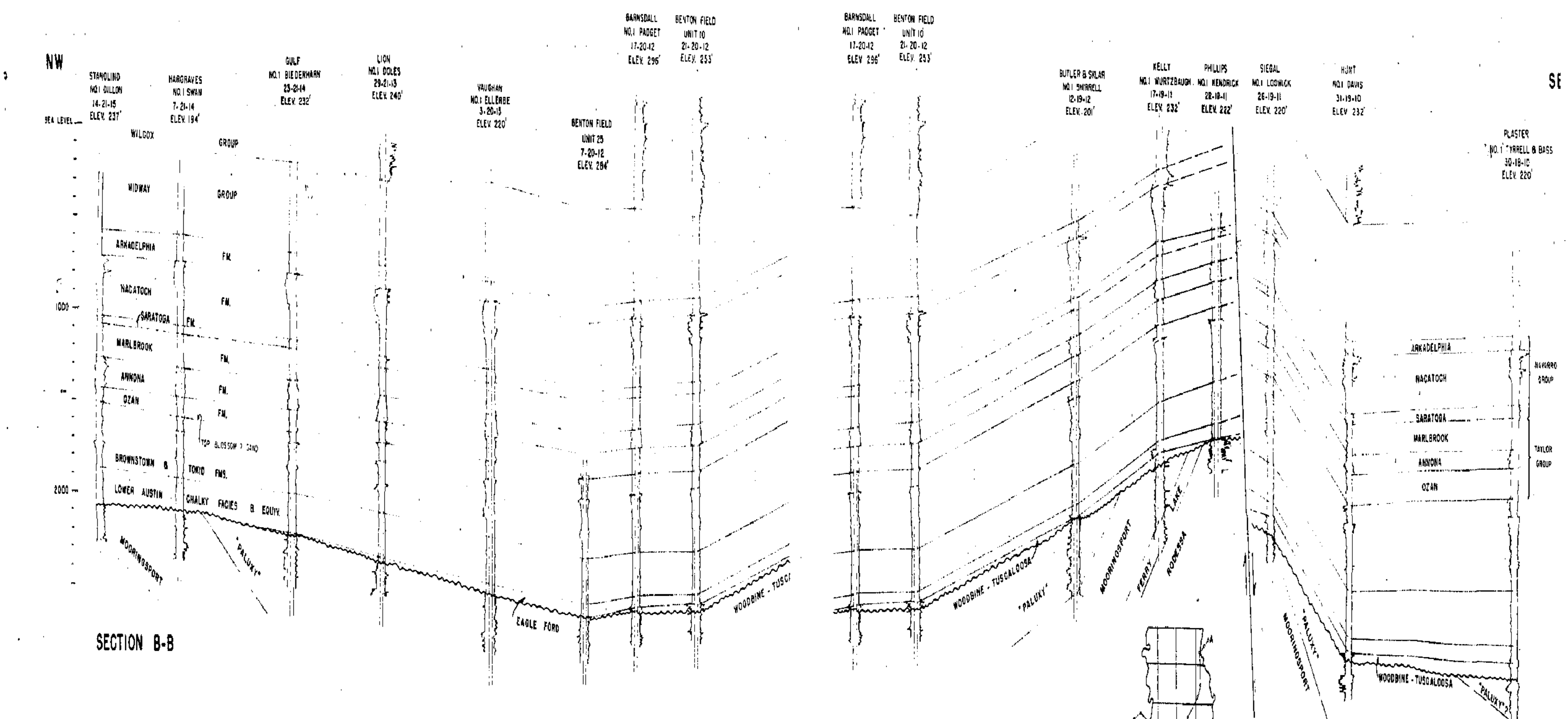


R14W
R13W
R12W
R11W
T23N
T22N
T21N
T20N
T19N
T18N
700
800
600
500
400
300
200
100
900
+100


T20N
T19N
T18N
T17N
T16N
T15N
700
600
500
400
300
200
100
0
-100
300
200
100
STRUCTURE MAP OF BOSSIER PARISH
CONTOURED ON BASE OF THE WILCOX GROUP
CONTOUR INTERVAL: 20 FT.
PLATE 3



SECTION A-A



SECTION B-B

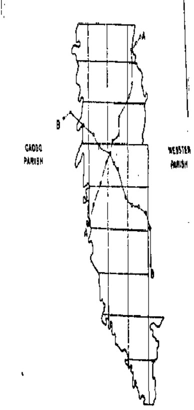
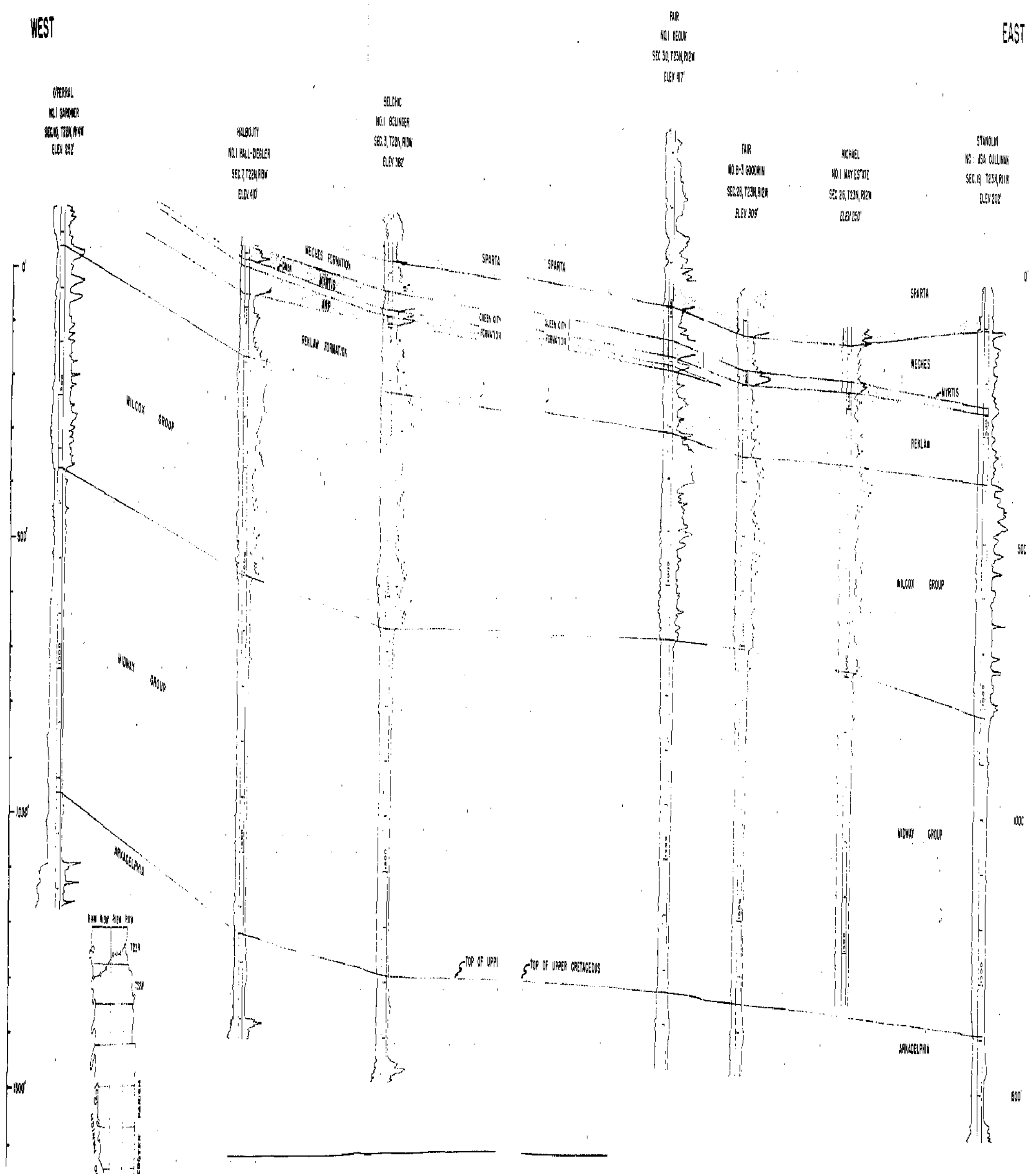


PLATE 7

STRUCTURAL CROSS-SECTIONS SHOWING RELATIONSHIP OF TAYLOR AND NAVARRO GROUPS IN BOSSIER NAVARRO GROUPS IN BOSSIER PARISH



CROSS-SECTION OF NORTHERN BOSSIER PARISH SHOWING RELATIONSHIP OF SUBSURFA... OF SUBSURFACE TERTIARY UNITS

PLATE 8

COMPOSITE COLUMNAR SECTION
COUSHATTA BLUFF TO DUTCH JOHN BLUFF

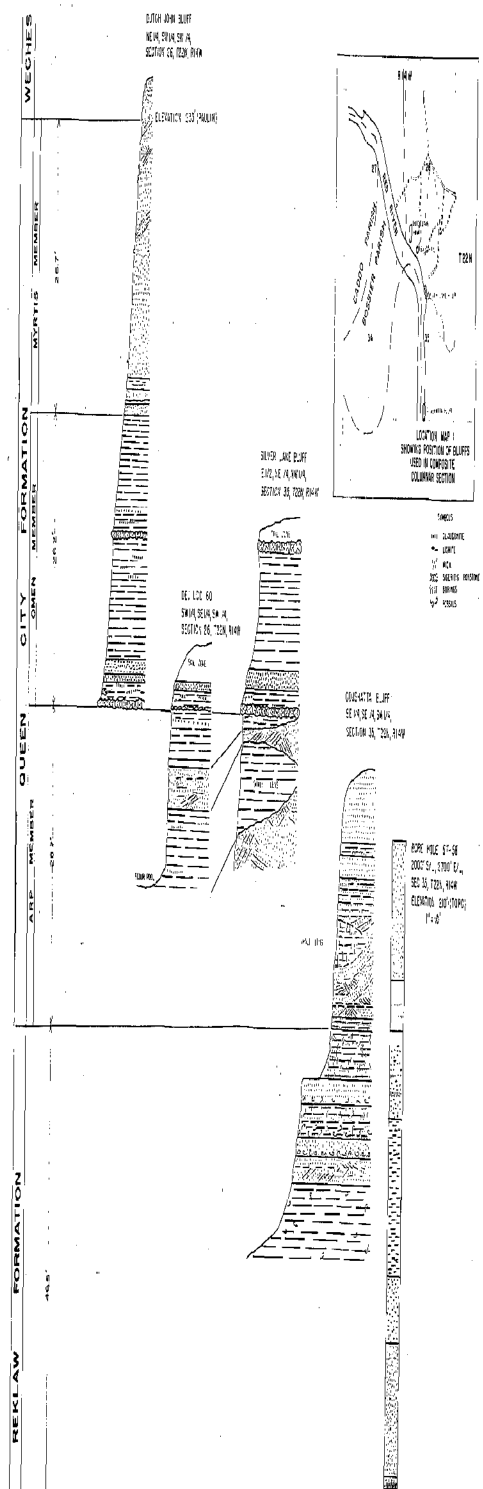
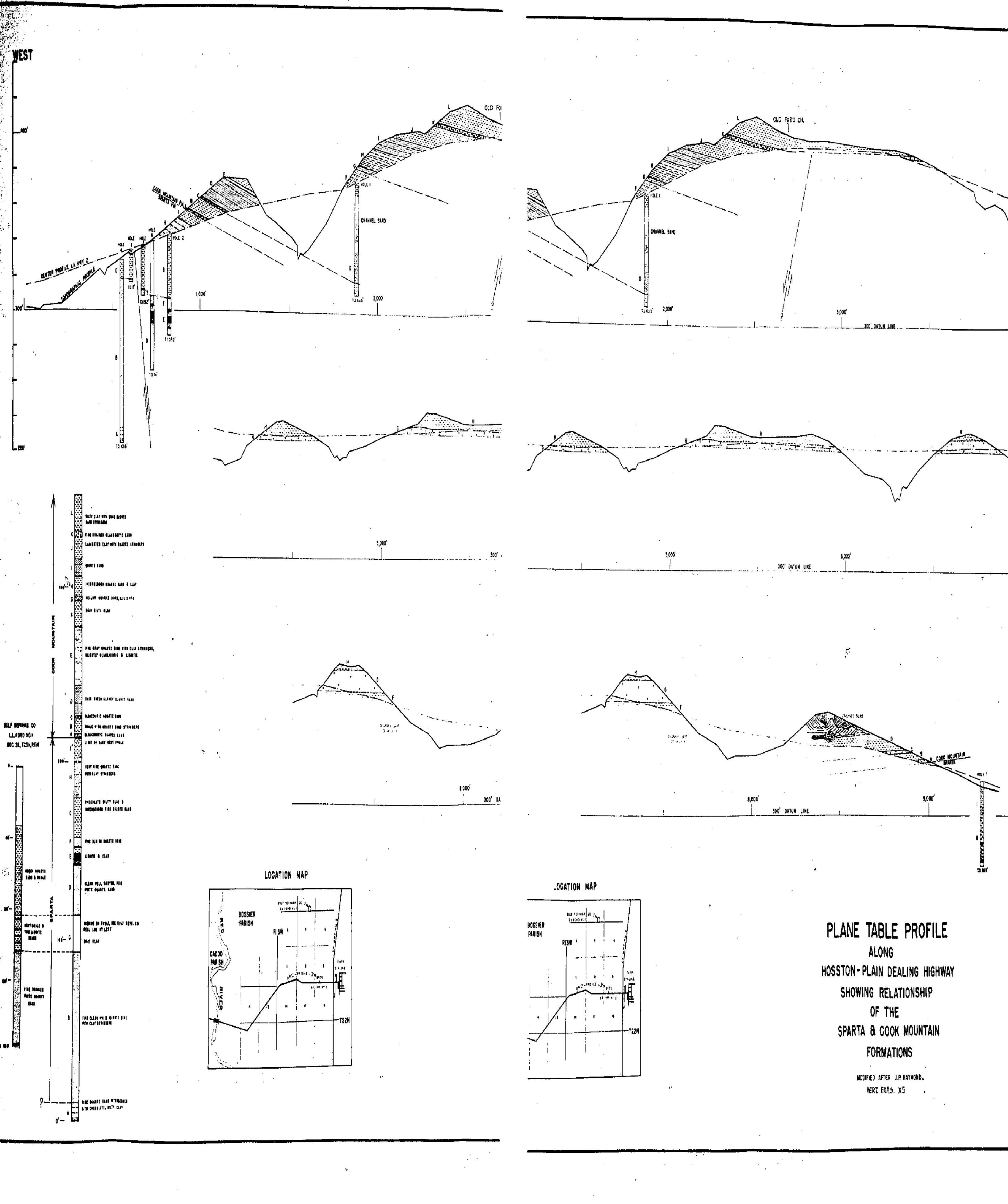
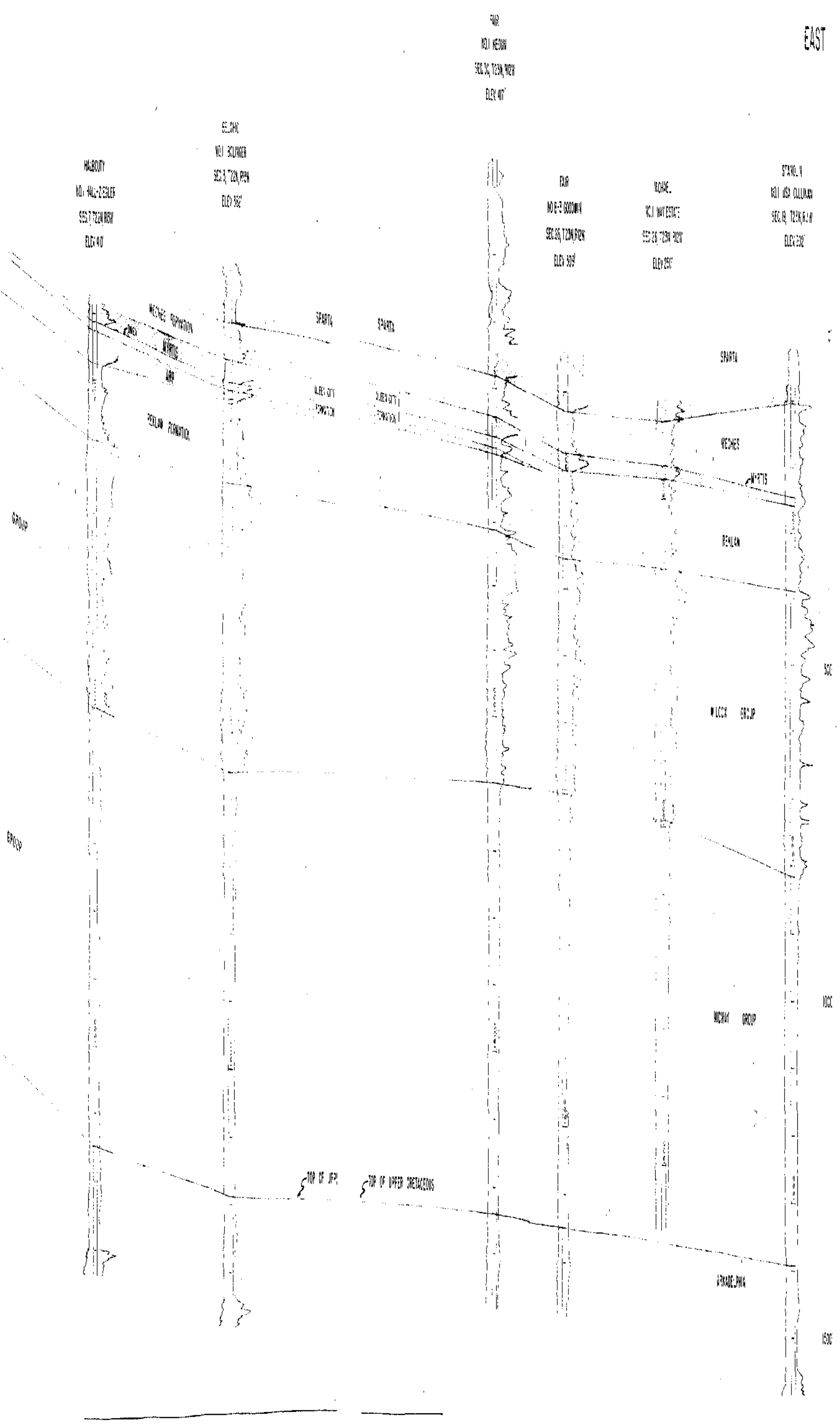


PLATE 9



PLANE TABLE PROFILE
ALONG
HOSSTON-PLAIN DEALING HIGHWAY
SHOWING RELATIONSHIP
OF THE
SPARTA & COOK MOUNTAIN
FORMATIONS

MODIFIED AFTER J.P. RAYMOND.
VERT. EXAG. X5



CROSS-SECTION OF NORTHERN BOSSIER PARISH SHOWING RELATIONSHIP OF SUBSURFA... OF SUBSURFACE TERTIARY UNITS

PLATE 8

COMPOSITE COLUMNAR SECTION
COUSHATTA BLUFF TO DUTCH JOHN BLUFF

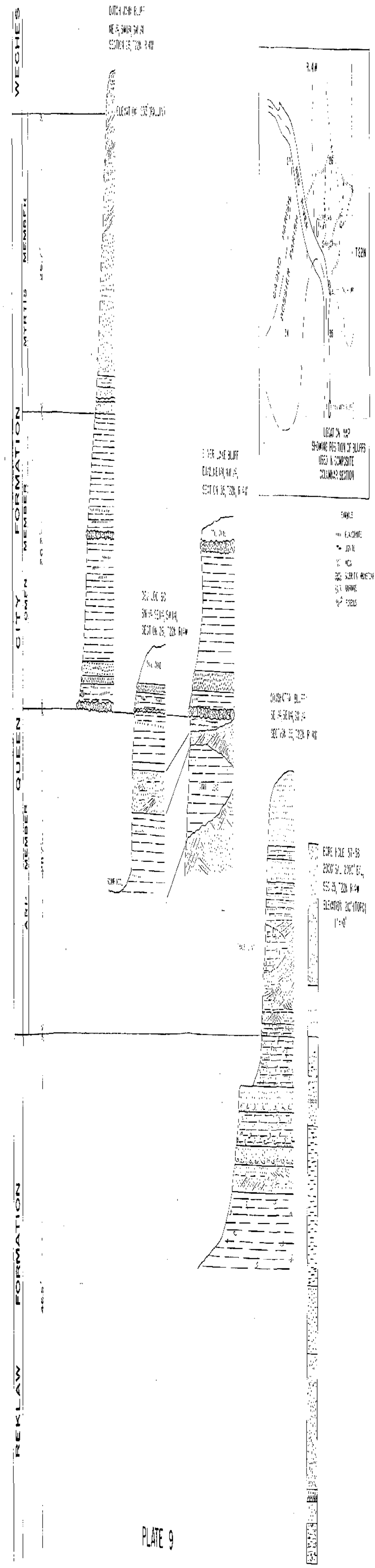
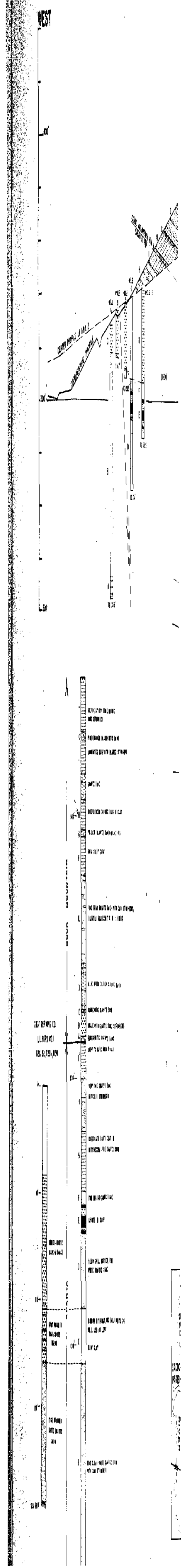
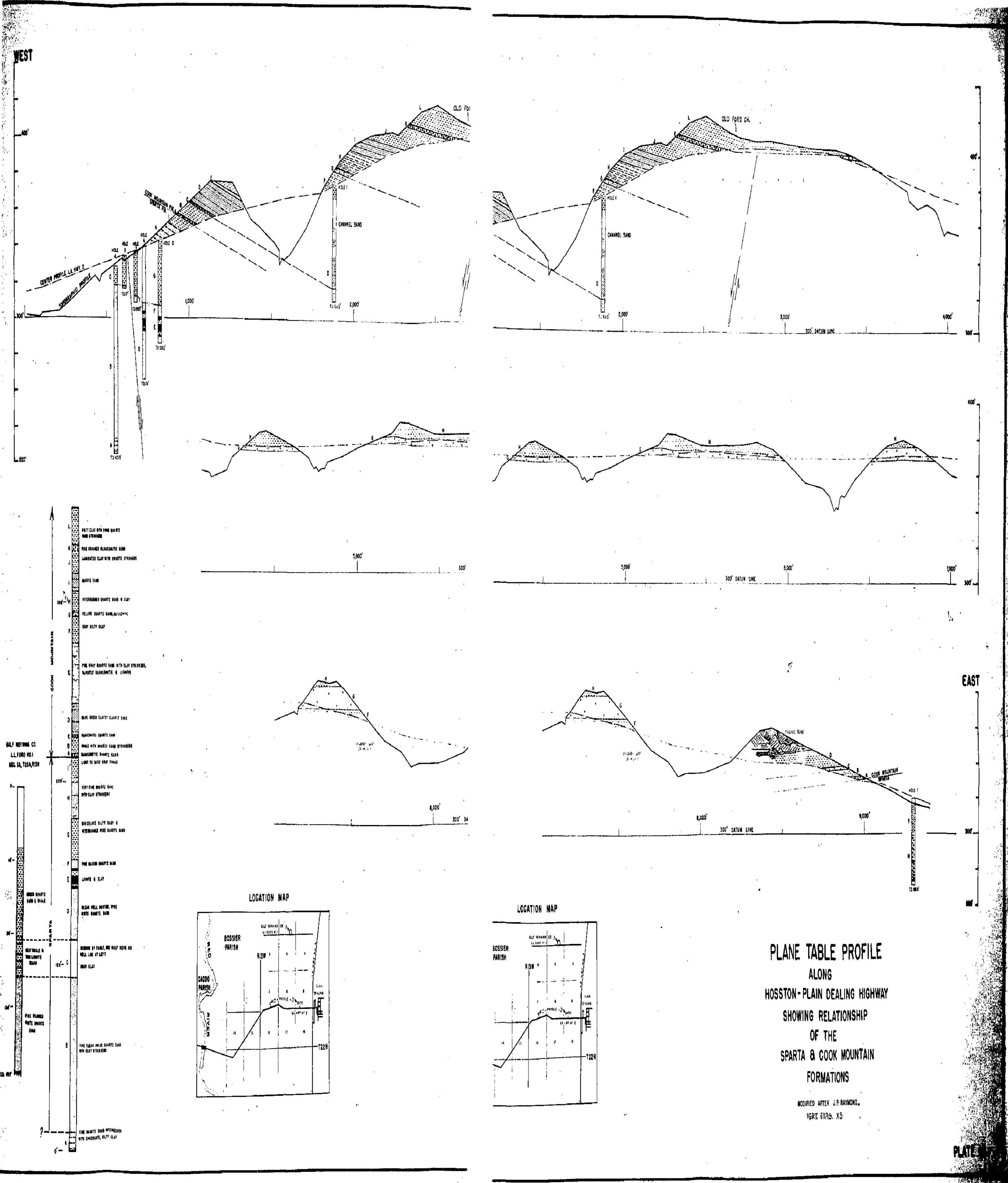


PLATE 9




WEST
EAST
COOK MOUNTAIN FM.
SPARTA FM.
CENTER PROFILE LA. HWY 2
TOPOGRAPHIC PROFILE
OLD FORD CH.
CHANNEL SAND
300' DATUM LINE
COOK MOUNTAIN
SPARTA
LOCATION MAP
BOSSIER PARISH
CADDO PARISH
RED RIVER
T22N
PLANE TABLE PROFILE
ALONG
HOSSTON - PLAIN DEALING HIGHWAY
SHOWING RELATIONSHIP
OF THE
SPARTA & COOK MOUNTAIN
FORMATIONS
MODIFIED AFTER J.P. RAYMOND.
VERT. EXAG. X5
PLATE